SB-412A

Switchboard
Main Station

INSTRUCTION
and
SERVICE MANUAL

945 Camelia St. Berkeley, California 94710 510-527-6666

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** DOCUMENTATION ADDENDUM **
** SB-412A MANUAL **
** REV.A **
** November 17, 1987 **
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MIC TO LINE GAIN LEVEL INCREASE

In effecting a 4dB Mic to Line increase in gain level, the following changes have been made:

Change:	At:	To:
22K OHM	R126, 109 100, 91	39K OHM
4.7K OHM	R45	6.8K OHM

SB-412A Installation & Operation Manual

I. INTRODUCTION
- A. Clear-Com Concept.....1
- B. SB-412A Description.....2

II. INSTALLATION
- A. Maximum Number of Stations....3
- B. Interconnect Cable.....4
- C. System Architecture.....7
- D. System Wiring.....8
- E. Mounting the Station.....16
- F. Station Connection.....16
- G. Set-Up.....16
- H. Headsets & Mics.....18
- I. System Check.....18

III. OPERATION
- A. Quick Guide.....19
- B. Operating Controls.....21
- C. Special Features: ISO, IFB, Split-Feed.....24

IV. TECHNICAL INFORMATION
- A. Circuit Operation.....25
- B. Maintenance & Warranty.....26
- C. Troubleshooting.....27
- D. Specifications.....29
- E. Parts Lists.....30
- F. Component Locations.....33

BLOCK DIAGRAM & SCHEMATICS...35

NOTICE:

"While Clear-Com makes every attempt to maintain the accuracy of the information contained in its product manuals, the information is subject to change without notice."

I. INTRODUCTION

I. A. The Clear-Com Concept

Clear-Com is a closed-circuit intercom system that consistently provides high-clarity, two-way communications in high-noise and low-noise environments. A basic system consists of a single- or multi-channel power supply or main station connected to various single- or multi-channel remote stations.

Clear-Com manufactures a wide variety of both portable and fixed-installation units. All are compatible with each other (Clear-Com can also interface with other communication systems; see Section IID or ask your dealer for details).

Clear-Com stations are interconnected with two-conductor, shielded microphone cable, using 3-pin XLR connectors. One wire carries the DC power (28-30 volts) from a main station or power supply to all remote stations, and the other wire carries audio information. The shield acts as a common ground. Only one termination is needed throughout the intercom network, and is located in a main station or power supply.

Clear-Com is a distributed amplifier system; each main and remote station houses its own mic preamplifier (for headset or speaker) and signalling circuitry. The Automatic Headset Detection circuit shuts off when any station's mic preamp is disconnected, so background noise on the line is not increased by an unused yet on-line station. Low-impedance mic input lines (200 ohms) and specially designed circuitry make Clear-Com channels virtually immune to RFI and dimmer noise.

Clear-Com main stations, power supplies, and certain remote station each have an auxiliary program input with its own volume control, which allows an external source to be fed to the intercom system. Visual Signal Circuitry, a standard feature on most main and remote stations, allows the user to attract the attention of operators who have removed their headsets.

Depending upon the type of main and remote stations selected, a maximum number of remote stations from 13 (all speaker stations) to 100 (all headset stations) can be distributed along a mile of wire. Remote stations bridge the intercom line at a very high impedance, and place a minimum load on the line. Audio level always remains constant, and does not fluctuate as stations leave or join the network.

The 28-30 volts DC provided by main stations and power supply units enable remote stations to operate with minimal current (10 milliamperes quiescent for headset stations, 20 mA quiescent for speaker stations) while generating extremely loud listen volumes (greater than 110 dB SPL). The higher voltage and low current keep voltage losses to an absolute minimum in long lines. If the voltage drops due to the addition of great lengths of cable or many more stations, Clear-Com equipment will continue operating with less than 12 volts available.

I. B. SB-412A Description

The SB-412A is designed for applications in which a person needs to communicate with up to four other people or groups of people and be able to quickly change any remote station's channel assignment from the front panel.

The SB-412A's four main intercom channels can be accessed either individually or simultaneously, while still maintaining isolation between channels.

Access to the four main channels is controlled by the row of pushbutton and toggle switches along the bottom right side of the front panel. Separate controls for talk and listen for each channel enhance the station's versatility.

The twelve switchboard inputs are individually assigned to one of the four main channels or to an isolated OFF position, via the matrix switches on the left half of the front panel.

Controls which affect the input and output at the station (mic, headsets, speaker, and program) are located in a row along the upper right of the front panel. Controls that are recessed behind the front panel are normally used only during installation and set-up.

The SB-412A is self-powered, and can also power up to 20 speaker stations or 100 headset stations. It is normally used as a main station (which provides system termination at a central location), but may be used also as a remote station that provides extra power capacity.

On the SB-412A rear panel, one XLR connector for each of the four channels and the twelve switchboard inputs allows easy connection to the rest of the system. A program (auxiliary) input on the rear panel allows an external program to be monitored at the station and/or sent on one (or more) of the intercom channels. Its preamp gain is switchable for mic- or line-level inputs. An external speaker jack is also provided.

Special functions, allowing ISO and IFB, may be set up with internal jumpers. See Section III for a detailed discussion of all controls and jumpers.

II. INSTALLATION

II-A. Maximum Number of Stations

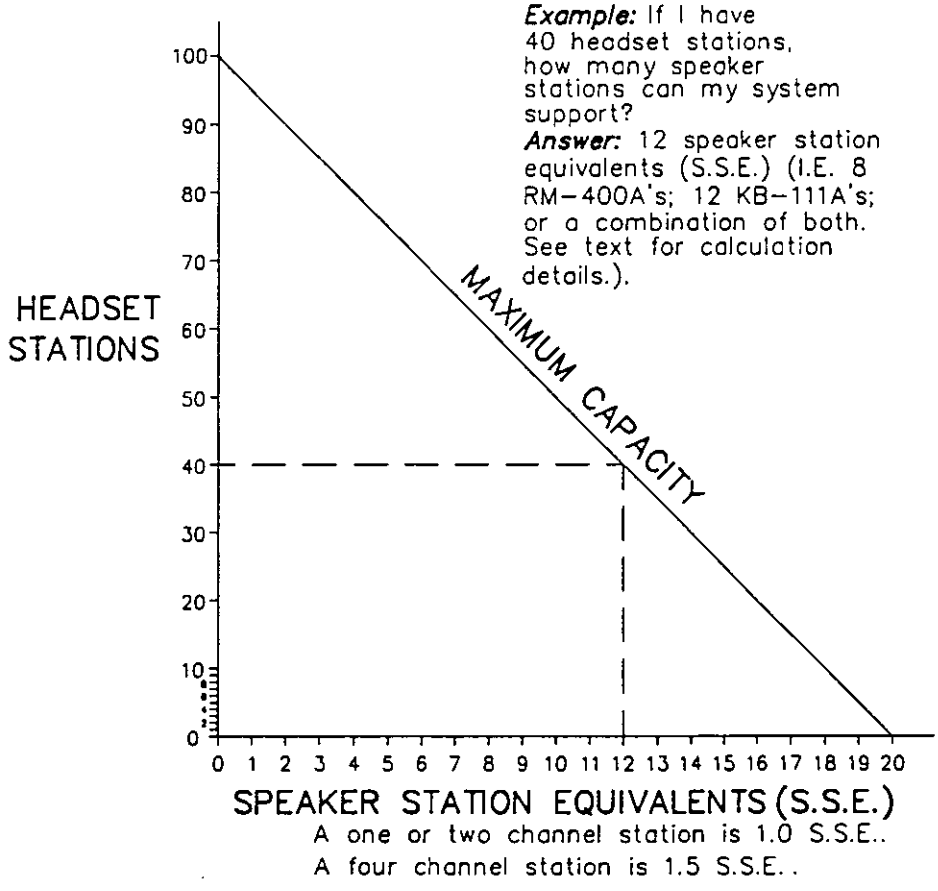
The SB-412A has a maximum output current capacity of two amps; the total current draw on all channels cannot exceed this output. The maximum number of remote stations that one SB-412A will support depends upon three factors:

1) the current requirements of each remote station
2) the cable length
3) the cable gauge

If your system includes headset stations **only**, the SB-412A can operate a maximum of 100 units. If your system contains speaker stations only, the SB-412A can operate up to 20 units (note: if all remote stations are RM-400A's, the maximum capacity is 13). If your system contains a combination of headset and speaker stations (typical of most applications), you must determine the maximum system capacity.

Consult the graph below. Match the number of speaker stations in your system to the number of headset stations. If the point reached falls within the shaded section of the graph, one SB-412A will operate the entire system with no reduction in performance. In situations where a significant current drain occurs 1000 feet or farther from the SB-412A, an additional power supply (or main station) or an extra large gauge cable may be necessary to insure sufficient voltage for full output without clipping. Any number of Clear-Com main stations and/or power supplies may be connected in parallel.

In all cases, multi-pair shielded mic cable should be used to interconnect all stations. The next Section describes cable requirements in detail.



Example: If I have 40 headset stations, how many speaker stations can my system support?
Answer: 12 speaker station equivalents (S.S.E.) (I.E. 8 RM-400A's; 12 KB-111A's; or a combination of both. See text for calculation details.).

Maximum Number of Remote Stations

II-B. Cable Considerations

The SB-412A contains one XLR-type, 3-pin male connector for each of the four main intercom channels and for each of the 12 switchboard lines (total, 16 output connectors). You'll route shielded cable from the rear panel of the SB-412A, then connect it to all the remote stations in the system. Allow 3 inches behind the unit for cables to extend from the rear panel. Avoid sharp bends in cabling.

Depending upon your application, you will run separate cables for each channel going to the single-channel remote stations, or two channels (any combination) together to two-channel remote stations (crosstalk considerations discussed later in this section).

When choosing interconnect cable, keep the following considerations in mind:

1) DC resistance of the ground or common conductor affects crosstalk. In permanent installations, do not use wire smaller than 20 gauge, stranded (except runs shorter than 100 feet). Keep the total resistance of the ground under 2 ohms.

2) The capacitance of the interconnect cable affects the frequency response and sidetone stabilty. Total capacitance should not be greater than .25 microfarads (capacitance between conductor and shield; equivalent to an intercom system containing 5000 feet of cable at 50 pF per foot).

3) Clear-Com Systems operate best with cable that has no more than 35 pF from conductor to conductor, and no more than 70 pF from conductor to shield.

PORTABLE INSTALLATION CABLE
Typical cable for portable system interconnection is rubber-jacketed, two-conductor, shielded microphone cable. We suggest you try BELDEN 8413 (24 gauge, stranded) for connections totalling 500 feet or less, and BELDEN 8412 (20 gauge, stranded) for connections running from 500 to 5000 feet.

Portable remote stations such as beltpacks each have a pair of input and output connectors; when installing a system that includes these, you can daisy-chain many stations along one interconnect path. Or, you can use Clear-Com's line splitter (one input, three outputs) to feed individual lines to station inputs (see diagrams on the following pages for various configurations). Daisy-chaining and line splitting decrease the amount of cable required and simplify installation.

PERMANENT INSTALLATION CABLE
We recommend you use vinyl-insulated and jacketed cable for connections to permanently-installed stations; it costs less and is easier to pull through conduit than the rubber-insulated cable.

You must use low capacitance cable. We suggest you try BELDEN 8762 (20 gauge, stranded) for applications up to 500 feet, and BELDEN 8760 (18 gauge, stranded) for up to 5000 feet.

If conduit is available when installing permanent remote stations, run interconnect cables through the conduit to each wall- or console-mounted unit. NOTE: **chassis ground and signal ground (XLR connector Pin 1) are NOT the same point. DO NOT connect the chassis to Pin 1.** The chassis is insulated from the signal ground with a capacitor (.01 microfarad, 1.4 kv). This eliminates the hum and potential shock hazard that can arise if stations are at a different ground potential.

In some situations, existing wire in a conduit may be used; consult the factory for guidelines.

In installations where conduit is NOT used, and equipment doesn't share a common ground, it is good engineering practice to run an additional ground wire to tie all chassis together (this decreases susceptibility to electrical noise fields).

--continued--

If you don't use Belden cable, use a similar type, with wire gauges and capacitance as specified in this manual. The conductors in the cable, especially in longer runs (over 500 feet) must have low DC resistance (less than 15 ohms per 1000 feet; large diameter conductors) and low capacitance (less than or equal to 55 pF per foot of cable--capacitance between conductor and shield).

Refer to the Belden wire specs on page 6 to ensure that your substitute cable is comparable.

MULTI-CHANNEL CABLE CONSIDERATIONS

When installing a system that includes multi-channel stations, the channel feeds may be routed individually to each station with separate two-conductor shielded cables OR four channel feeds may be routed together with one four-pair shielded cable (such as BELDEN 8725; see multi-channel cable connection diagram on page 6). Two channel feeds may be routed with a two-pair shielded cable (such as BELDEN 8723).

Crosstalk

When multiple channels are fed to remote stations, the amount of crosstalk is proportional to the amount of DC resistance in the ground return. Two ohms or less resistance is ideal; two ohms will give you 40 dB of isolation. Anything greater than two ohms will increase crosstalk. Each channel must be fed in its own separate shield.

When connecting four-pair cable between multi-channel stations, all the shields and ground wires should be connected, effectively lowering ground resistance and reducing crosstalk. Refer to the diagram on pages 6 & 9. Also, tie unused wires in your interconnect cable to ground (Pin 1), thereby further reducing crosstalk.

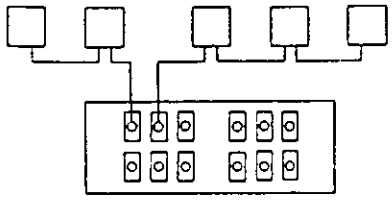
II-D. System Wiring

Both physical and electrical considerations are involved in determining the best system wiring configuration. The physical aspects center around ease of wiring, whereas the electrical aspects are dictated by performance requirements of the entire system and/or particular stations in the system. The two main electrical considerations for the cable are resistance in the conductors and capacitance between the conductors.

Build-up of resistance in the cable results in a loss of sidetone null at remote stations, some level loss from remote stations to the main station, reduced headset/speaker output before clipping, and, in the ground conductor, a serious increase in crosstalk.

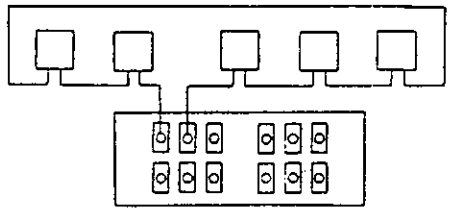
Build-up of capacitance results in reduced sidetone null at all stations on the line(s) in question, and reduced voice clarity due to excessive high-frequency roll-off.

There are three main methods of configuring your system wiring (ANY combination of them can be used in one system):



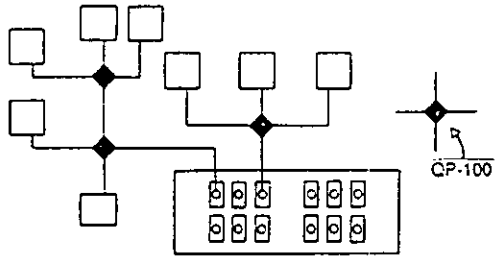
Daisy-Chain

1. This **daisy-chain** method requires the least amount of cable, but may be impractical because of your facility's physical layout. Also, if a break occurs in cabling, all stations beyond the break are disabled (this problem is solved by the **loop-through** shown in Method 2):



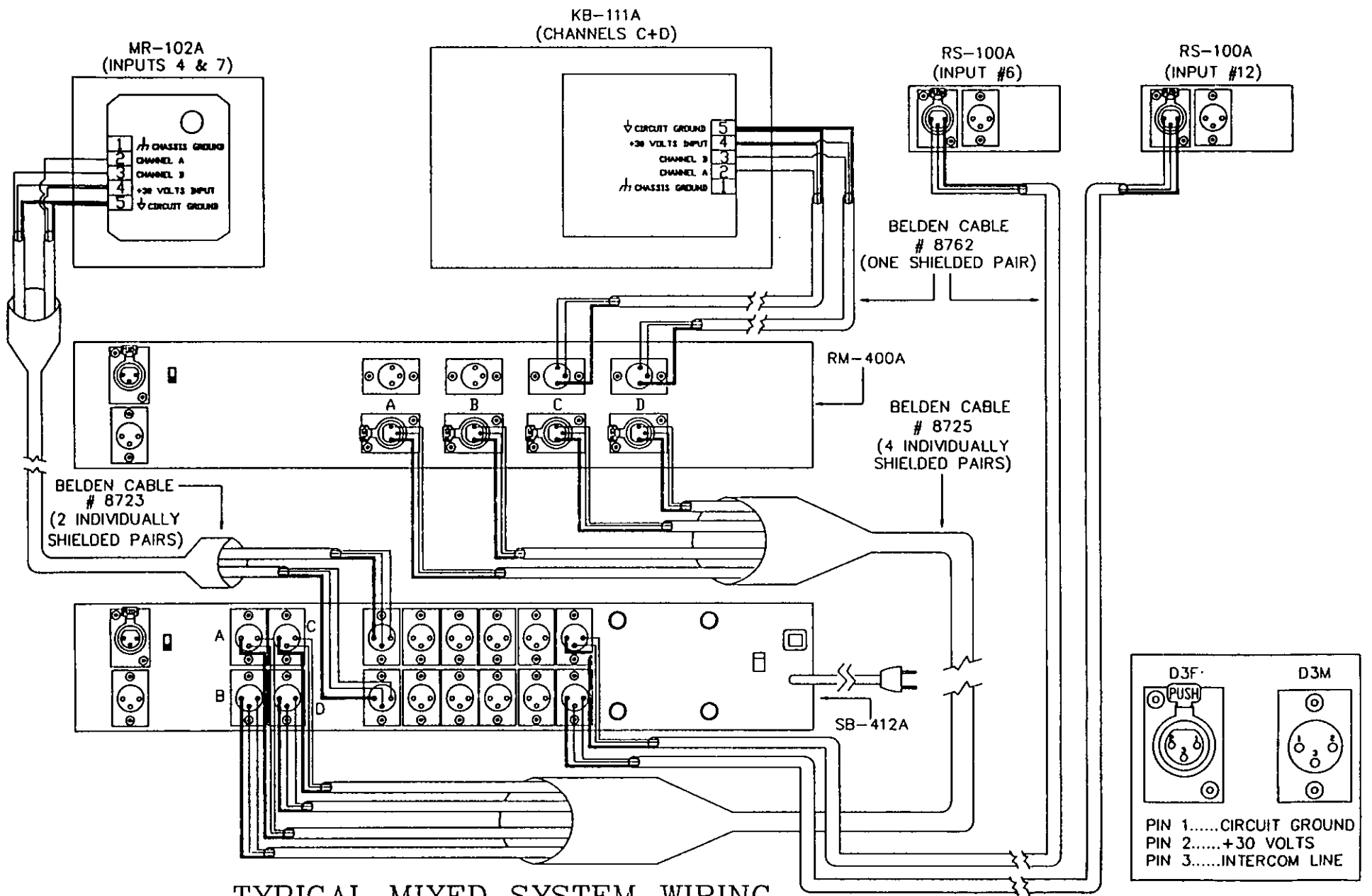
Loop-Through

2. Method 2 provides another advantage in that the DC resistance accumulated in the cable is no more than half as great as in the standard daisy-chain arrangement. However, it also results in a cumulative cable capacitance which may be twice as great as Method 1's.



"Hub"

3. This **"hub"** method is especially useful for belt-packs and situations in which running two cables to the remote stations is cumbersome. The hub method usually results in fairly low cable resistance between stations, but cumulative capacitance is often the highest of the three methods.

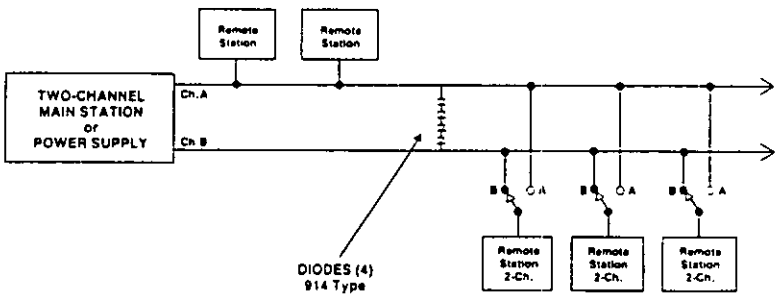


TYPICAL MIXED SYSTEM WIRING

Signalling Configurations in Multi-Channel Systems

In normal circumstances, the CALL light on a two-channel remote station lights only when someone signals on the channel that station has selected for communication. This is because the Visual Signal travels on the audio line in the form of DC voltage.

A simple modification may be made to the the system wiring so that stations which are switched to one channel will respond to a call signal on the other channel. This modification may be applied in both directions, so that all stations will indicate a call signal from either channel, white still maintaining two completely separate intercom channels (diagram shows how Channel A can send signals to Channel B):

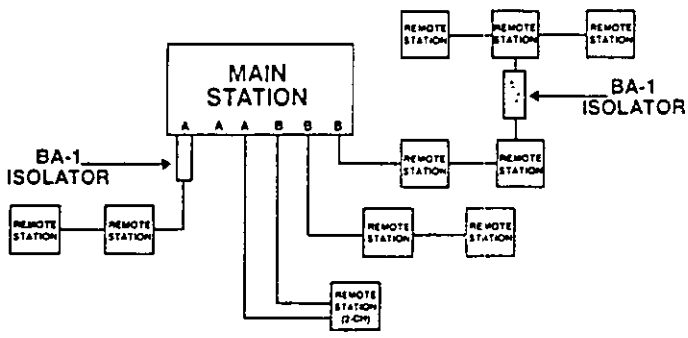


In-Line Isolation

In certain applications you may want to isolate conversations in one section of the system. Clear-Com offers **Model BA-1 In-Line Isolator**, which blocks intercom audio while allowing DC voltage to flow to an isolated "leg" of the system.

The BA-1 allows one channel to support several simultaneous and independent conversations. The main station cannot communicate with the isolated legs of the system. Private local conversations can go on along a common interconnect line without adding great lengths of cable or additional main stations. You may incorporate any number of BA-1 Isolator's, as long as the capacity of the main station is not exceeded by added remote stations.

There are a variety of ways to incorporate the BA-1 into a system. For instance, you can plug the BA-1 directly into a remote station's extension (output) connector, a main station's channel output connector, or between two runs of cable on any channel. This diagram illustrates two ways of isolating any section of your system:



Interfacing With Other Systems

Clear-Com's **Model AC-10K** Universal Interface, **Model AC-10H** Telephone Interface, **Model IF4-4** TV Camera Interface, and **Model TW-12** Two-Wire System Interface allow you to link Clear-Com with virtually any type of communications system. When your existing system is upgraded with Clear-Com equipment, you may continue to use portions of the older system. The AC-10K and AC-10H are called "Adapt-a-Com's" and guarantee compatibility with any in-house intercoms and other two-, three-, and four-wire systems. The AC-10H facilitates on-line communication via standard telephones, and helps you directly communicate with remote locations using two-wire or four-wire dedicated TELCO pairs.

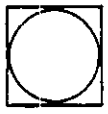
"Typical" Four-Channel Intercom Systems

The diagram on the next page shows standard Clear-Com systems for "typical" applications. Since your requirements are likely to differ, both the wiring and your choice of stations may vary.

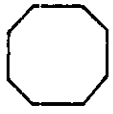
SYMBOL KEY:

Four-channel speaker station, rack-mount (RM-400A)

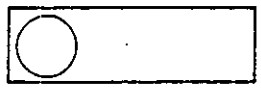
Two-channel speaker station, wall-mount (KB-111A, KB-112)



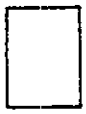
Two-channel speaker station, rack-mount (RM-120A)



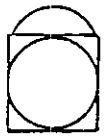
Two-channel headset station, wall-mount (MR-102A)



One- or two-channel belt-pack (CP-100, CP-300, RS-100A, RS-201)

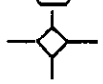


Two-channel speaker station, portable (KB-111AP, KB-112P)

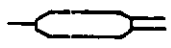


Two-channel wall plate (WP-2/WP-6)

Three-way line splitter (QP-100)



Universal interface (AC-10K or H)



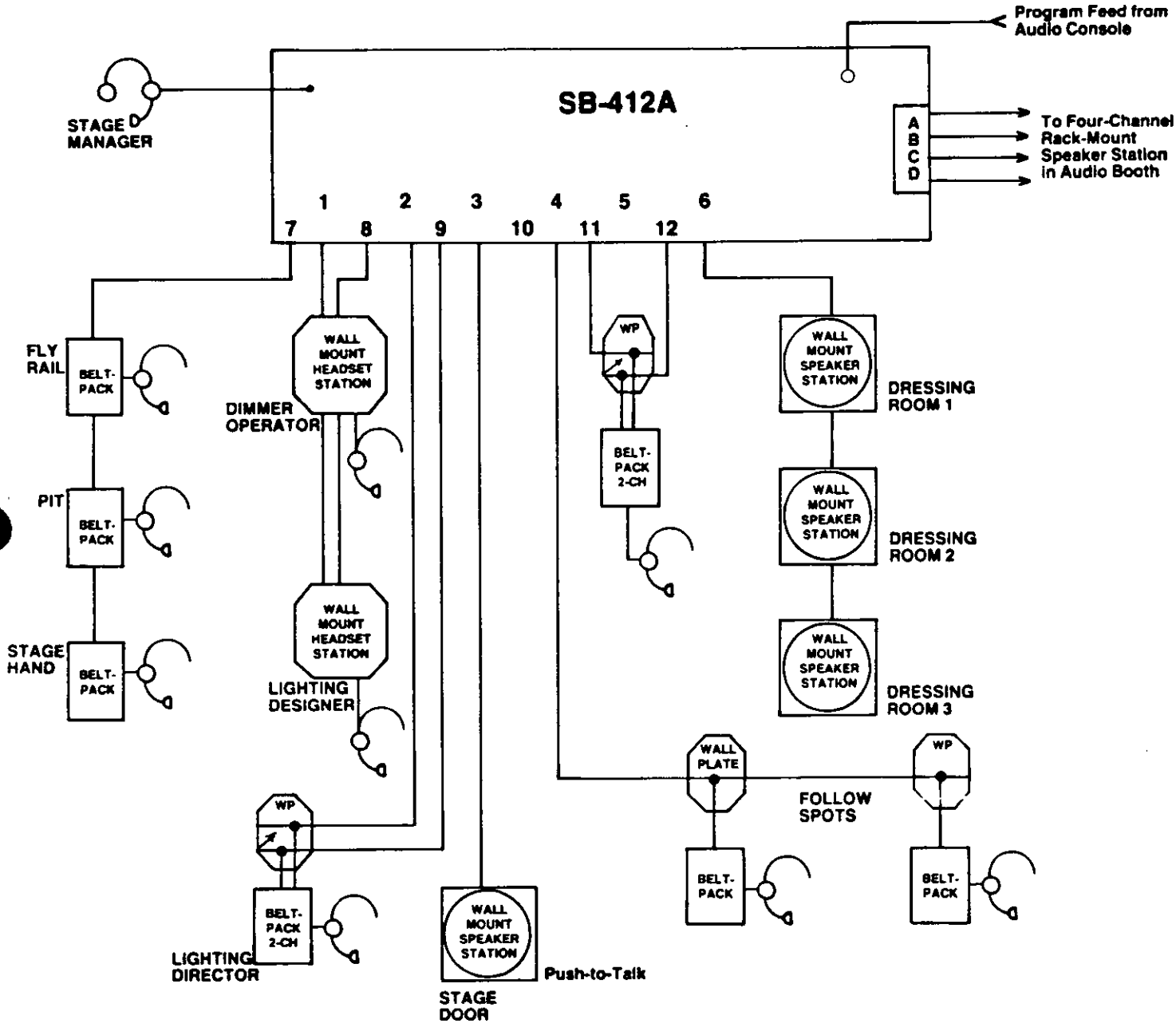
In-line isolator (BA-1)

Single-muff headset (CC-35B, CC-75B)

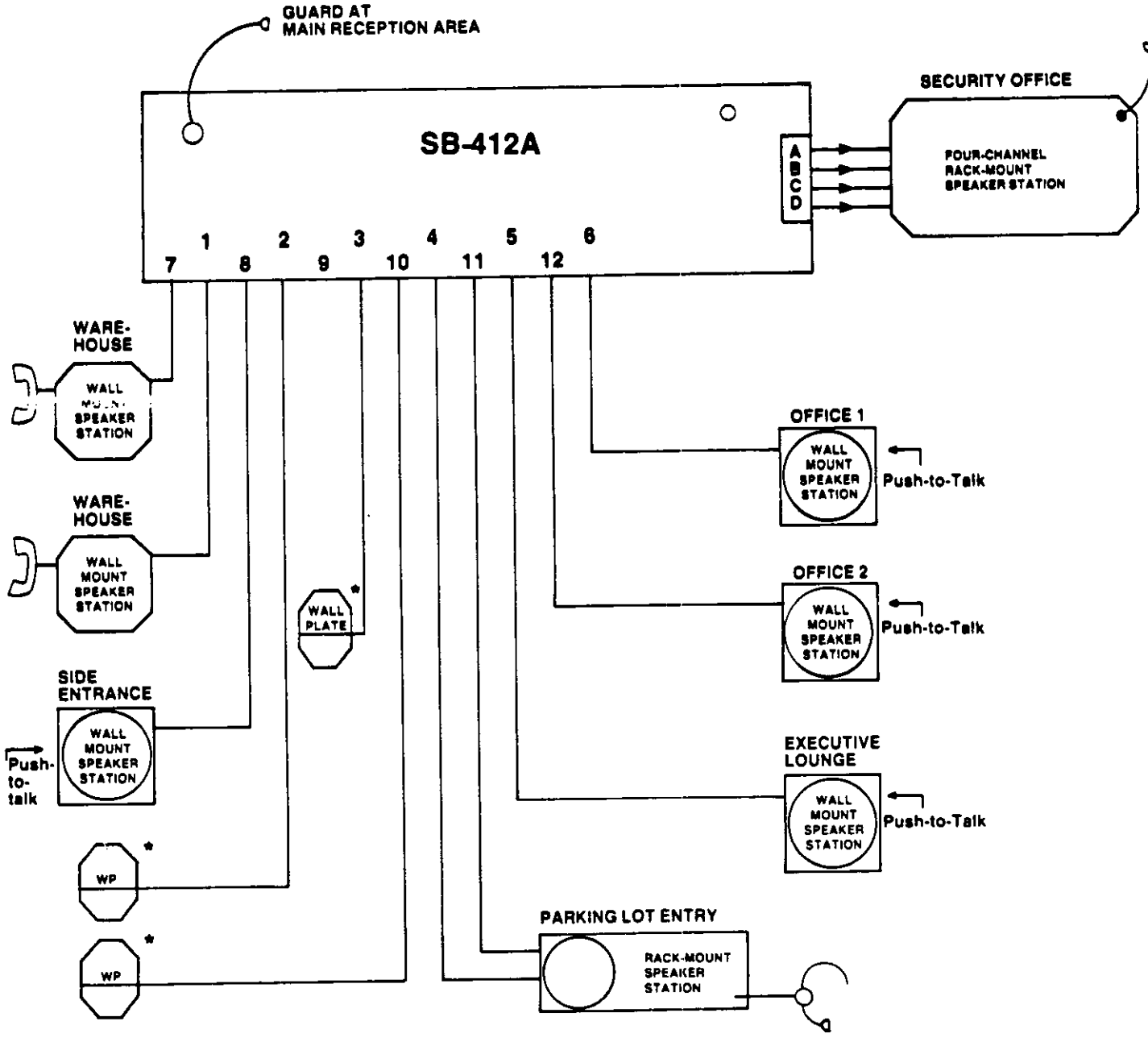
Double-muff headset (CC-55, CC-240B)

Handheld mic, push-to-talk (PT-4)

Handset, push-to-talk (HS-6)

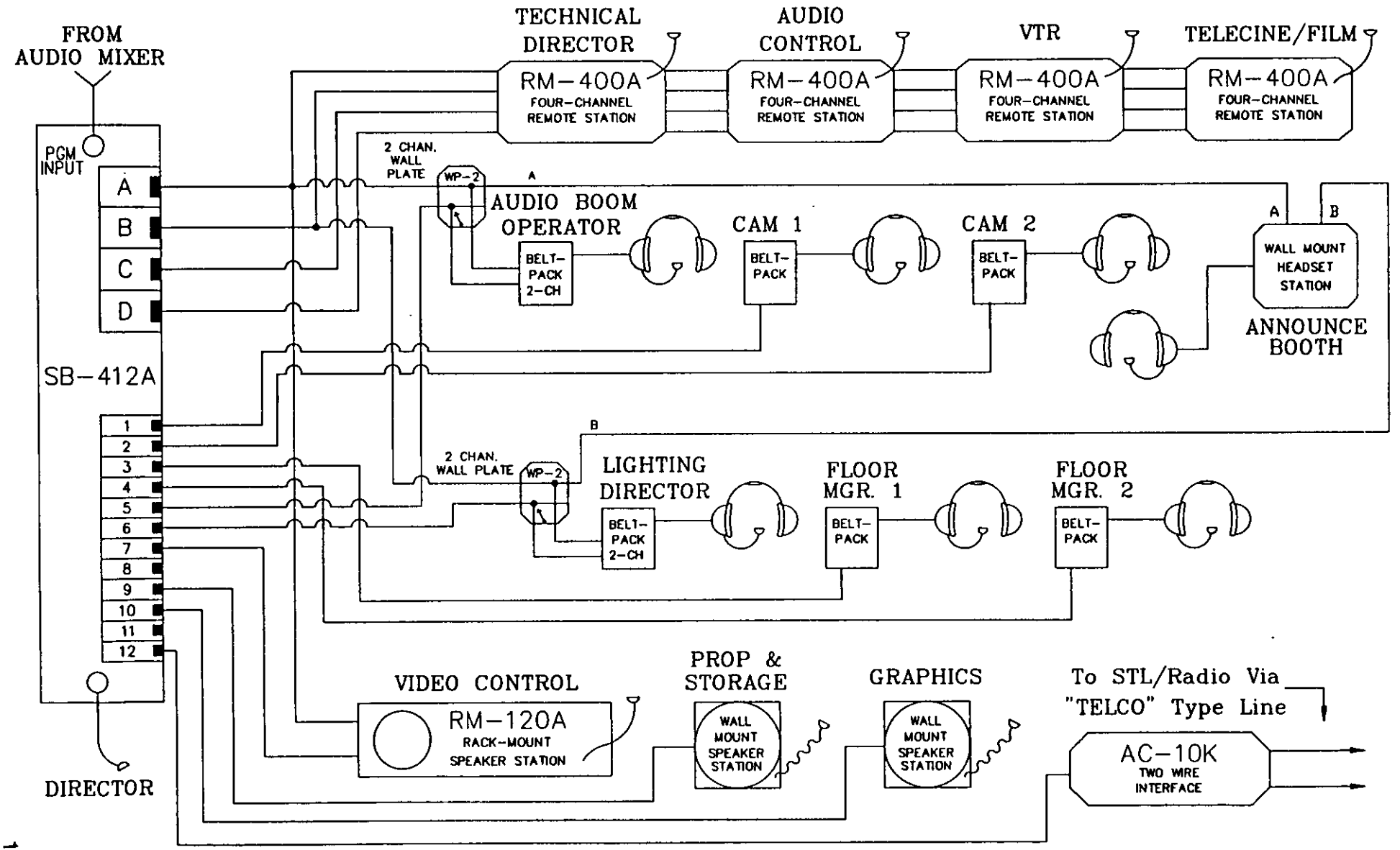


THEATRICAL INTERCOM SYSTEM



*WALL PLATES ARE INSTALLED IN VARIOUS LOCATIONS THROUGHOUT CORRIDORS OF BUILDING: ROAMING SECURITY GUARDS CARRY BELT-PACK STATIONS (with headsets) & PLUG INTO WALL PLATES WHERE NEEDED.

INDUSTRIAL SECURITY INTERCOM SYSTEM



TELEPRODUCTION INTERCOM SYSTEM

II-E. Mounting The SB-412A

The SB-412A is designed to mount in a standard 19" rack, using 3.5" vertically. It can also mount in a console or sit atop a shelf if necessary. The station extends 9" back from the front panel, but avoid sharp bends in cabling and allow an additional 3" behind the unit. If mounting the station in a console, the cut-out must be very accurate, as the front panel extends only a very small amount beyond the top and bottom of the chassis. See next page for mounting dimensions. Before mounting the station, insure that any special features you require have been set up (ISO or IFB operation or split-feed headphones).

II-F. Station Connection

Once you determine the configuration of your intercom system, decide upon a location for the main station. Then:

1) Position the unit near a source of 115 or 230 VAC (power consumption is 80 watts maximum).

2) Use standard multi-pair shielded cable described in Section IIB.

3) Route all cables from the remote stations to the main station. Use any or all of the thee wiring methods described in Section IID. Pin assignments for the rear panel intercom XLR connectors are: Pin 1, COMMON; Pin 2, +VDC; Pin 3, INTERCOM AUDIO.

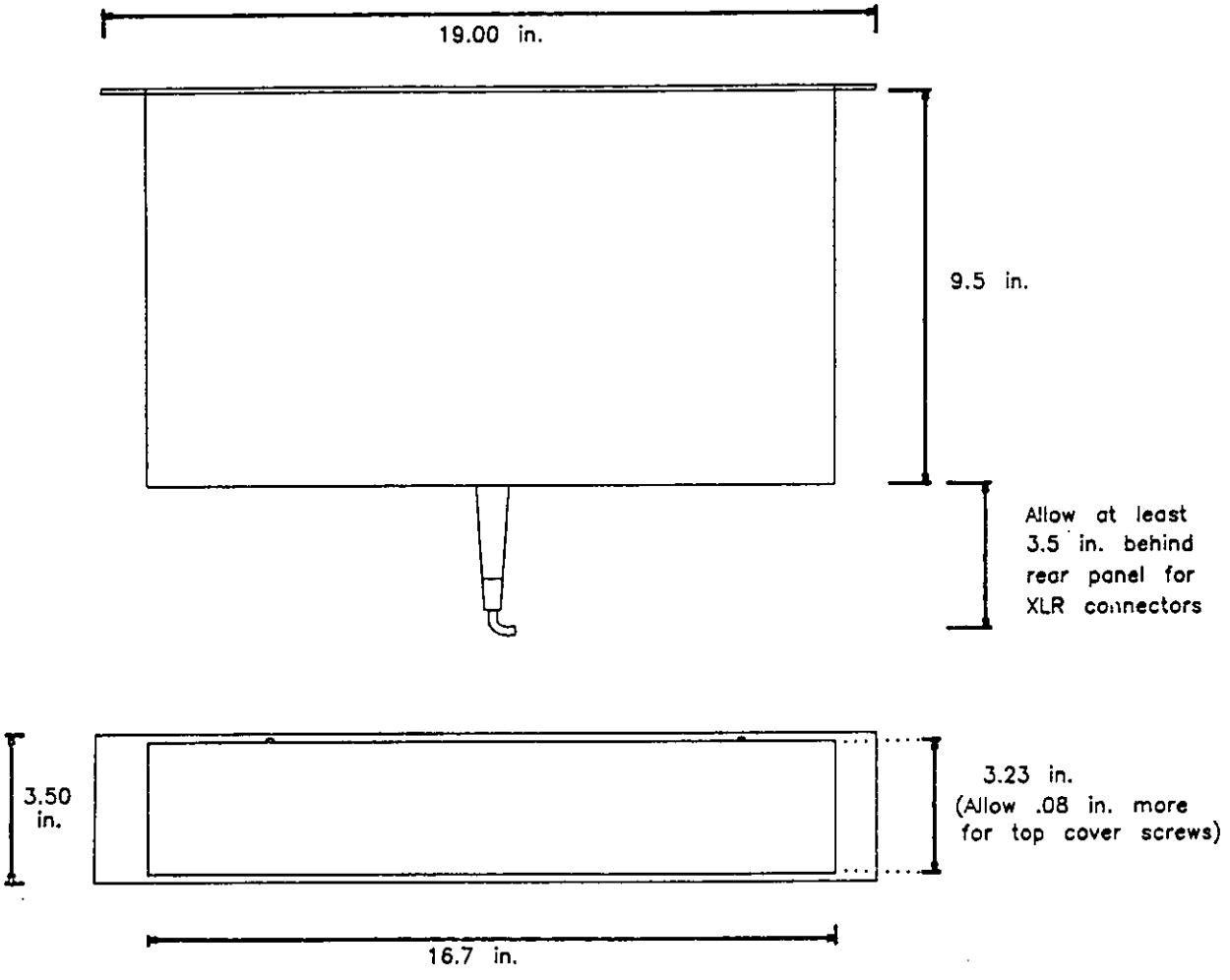
4) Route cables away from heavy AC power sources such as lighting panels or electric motors.

5) In permanent installations, cables should be installed in accordance with approved local building codes.

II-G. Set-Up

After connecting the SB-412A to the remote stations, set the channel access (talk presets) and termination switches. IMPORTANT: Before turning on the unit, be sure that the line voltage switch is correctly set, and that the fuse is the proper rating!

Next, check that the program gain switch is set to match the level of the ingoing program (mic- or line-level). Finally, adjust operating controls for desired operation and comfortable levels.


19.00 in.
9.5 in.
Allow at least 3.5 in. behind rear panel for XLR connectors
3.50 in.
3.23 in.
(Allow .08 in. more for top cover screws)
16.7 in.

MOUNTING DIMENSIONS

II-H. Headsets & Mics

All headset connectors in Clear-Com gear are the 4-pin, male XLR type. To assure proper level and performance, your headset (or handset or mic) should have the following characteristics--

Microphone type: dynamic
Impedance: 150-250 ohms
Output Level: -55dBv
Ear Element type: dynamic
Output Impedance: 300-2000 ohms

Clear-Com offers three standard headsets, all with boom-mounted, noise-cancelling microphones. Model CC-240B is a double-muff headset, and Model CC-75B is single-muff; both have boom-activated dynamic mics with built-in ON/OFF switches. Model DT-109/6 is a double-muff headset wired for binaural applications. Model PH-7 is a double-muff, high-fidelity headset with very wide frequency response, greater isolation from ambient noise, and extra-rugged physical construction.

Clear-Com's HS-6 telephone-style handset has a dynamic mic and a push-to-talk switch, and is interchangeable with the above headsets. Our Model PT-4 is a hand-held push-to-talk mic for use with speaker stations.

All headsets and handsets have field-replaceable cords.

An electret element gooseneck microphone, permanently mounted on the SB-412A, is available as a factory-installed option.

II-I. Check-Out

Connect a headset to the SB-412A and be sure that you can access (talk and listen) all channels needed, and that visual signalling works both to and from the station. The brightly lit button should become dim or go out again immediately after the calling station's Call switch is released. If the light stays bright, there is a problem with the termination in that channel. As a check for proper termination, connect a beltpack to each channel and verify that the voice null occurs at approximately the 4 o'clock position on the trimpot. If the null occurs near or before the 1 o'clock position, there is probably more than one termination on that channel. In units where good sidetone null is important (e.g., where a gooseneck mic and speaker are used simultaneously) this check should also be done for each of the station's sidetone null trimpots. They are located directly behind the unmarked holes next to each "talk" toggle switch.

The Stage Announce output should have the station operator's voice on it only while the front panel's "S/A" switch is engaged.

If any channels are fed Program from the SB-412A, the level to each channel may be adjusted using the trimpot(s) behind the access panel.

If any special functions have been set up, be sure to verify their operation.

III. OPERATION

III-A. Quick Operation Guide

1. Determine which main intercom lines are to be assigned to each channel. Plug connecting cable into the appropriate XLR connectors on the rear panel. Route cables from SB-412A to remote locations and connect it to the inputs of the remote stations.

2. Repeat Step 1 for the switchboard inputs. Remember that each switchboard input is internally terminated by the SB-412A. So, if any switchboard lines connect to another main station or power supply, switch OFF the termination at that station.

3. If program monitoring is desired, connect the program source to the PROGRAM input on the SB-412A rear panel and set the gain switch to match the source level. Connect a paging amp to the STAGE ANNOUNCE output, if used. Connect a monitor speaker (16 ohms is ideal) is to the EXTERNAL SPEAKER output, if used.

4. Be sure that the rear panel MAINS SELECT switch and fuse are correct for the AC power you're using, then connect the power cord and turn on the POWER switch (the switch will light up).

5. Determine the access methods required for each channel and set the appropriate "talk" DIP switches. Check the settings of the termination DIP switches, and be sure that each channel of every station in the system is connected to **one and only one** TERMINATION.

6. Plug in the headset or turn on the mic and speaker, turn the SIDETONE volume up to the 10 o'clock position, then carefully adjust the HEADSET or SPEAKER volume for a comfortable level without feedback.

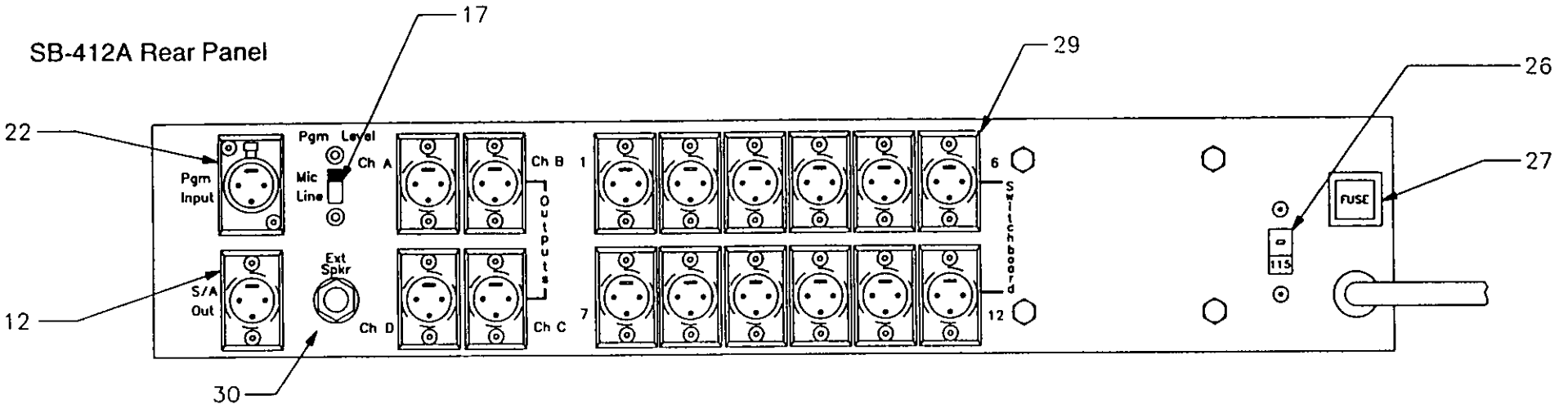
7. Enable communication with each channel using the TALK toggle and/or INTERCOM SELECT switches, and re-adjust the headset or speaker volume if necessary.

8. If applicable, adjust the program level to the station's headsets and speaker using the PROGRAM volume control, and set the level to the intercom lines with the individual trimpots behind the access panel.

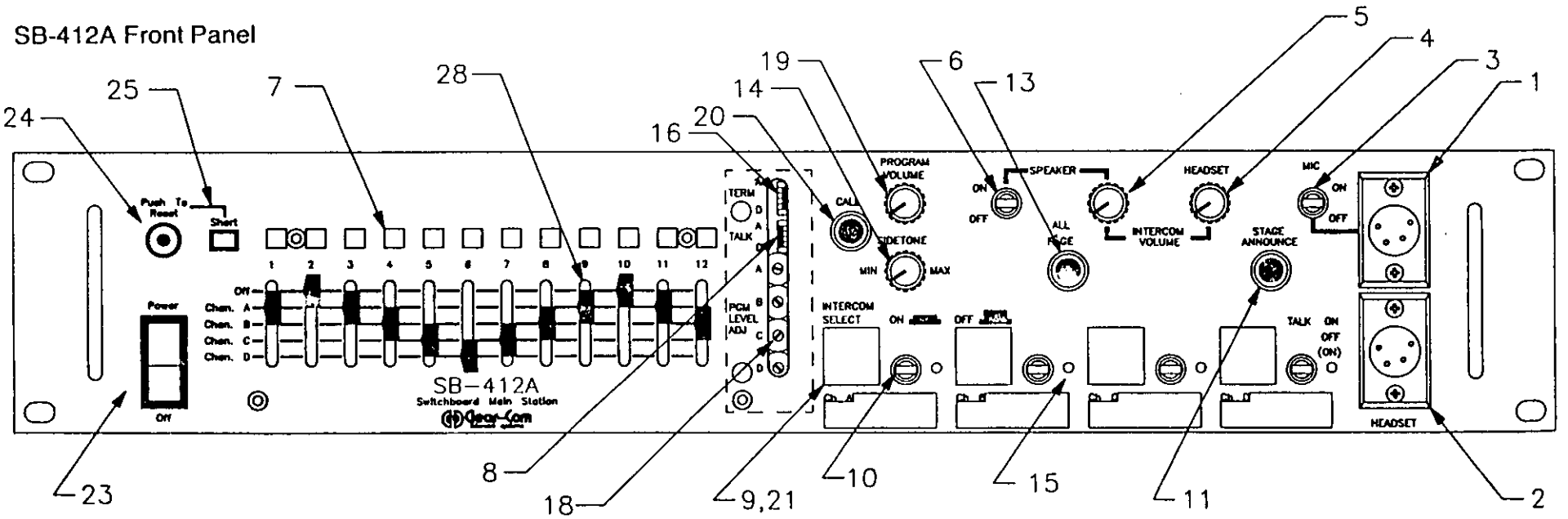
9. Check the SIGNALLING functions on each channel. Check operation of any special features and functions needed.

10. See Section IIIC to set up ISO or IFB access operation or SPLIT-FEED headset.

SB-412A Rear Panel



SB-412A Front Panel



III-B. SB-412A Operation

The controls on the surface of the front panel are used during normal operation of the station; the controls that are recessed behind the front panel cover plate are normally needed only during station set-up.

In the following explanation of controls, the boldface numbers in parentheses refer to the diagram of the SB-412A on page 18.

The SB-412A has two headset connectors (**1,2**); the mic input of the upper connector is switched by the MIC ON/OFF switch (**3**) located to its left. When neither headset jack is used, the mic preamp's gain automatically drops to near unity, to avoid noise pick-up from the unused input. (The gain of the switched mic input may be lowered by removing either R-15, 3 dB, or R-14, 5 dB. DO NOT remove both.) The headset connector pin-out is:

PIN 1-- MIC COMMON
PIN 2-- MIC HOT
PIN 3-- EAR ELEMENT COMMON
PIN 4-- EAR ELEMENT HOT

While using the SB-412A, do not position the headsets within two feet of an AC power transformer, or the mics may pick up hum.

If the optional gooseneck mic (**1**) is installed, it is controlled by the MIC ON/OFF switch.

The HEADSET VOLUME (**4**) and SPEAKER VOLUME (**5**) controls permit independent adjustment of the intercom audio level in the station's headset and external speaker outputs. If using an external speaker, connect it via the rear panel jack (**30**). The front panel SPEAKER ON/OFF switch (**6**) allows the external speaker to be muted instantly, without disturbing its volume setting.

Programming Channel Access

The set of recessed DIP switches that are labelled "Talk" (**8**) allows each channel's INTERCOM SELECT button (**9**) to be programmed for Talk access, as well as the usual Listen access that button controls. These switches are set OFF at the factory, so that Talk access is normally controlled only by TALK toggle switch (**10**). If the operator requires both Talk and Listen access when the Intercom Select button is engaged, set the talk pre-sets ON for the channel(s) desired.

Channel Access

The SB-412A operator accesses the desired main channel(s) by using the Intercom Select and Talk toggle switches. Each channel's Intercom Select switch is a push-on/push-off, illuminated switch. It lights dimly while engaged (brightly when a Call signal is received). It always switches the Listen path of its associated channel, and depending on the setting of the Talk pre-set, will also switch the Talk path. The Talk path may always be turned on with the Talk toggle switch, which has both momentary and locking positions.

Switchboard Matrix

The twelve assignment switches (**28**) let you assign the switchboard inputs (**29**, rear panel) to any one of the four main intercom channels (A, B, C, or D) or an isolated OFF position.

When switchboard inputs are assigned to the OFF position, they are isolated from all other switchboard lines and isolated from the four main intercom channels. The only links between the SB-412A operator and the switchboard line(s) in the OFF position are: to the remotes via the All Page function (described below) or from the remotes via the SB-412A's "call receive" LED's.

Stage Announce

The SB-412A operator presses the STAGE ANNOUNCE button (**11**), and audio from the SB-412A's mic(s) feeds to the rear panel S/A connector (**12**). Normally, the Talk signals to the intercom lines are inter-

rupted, but you may add a jumper across the switch to prevent this.

All Page

When the ALL PAGE button (13) is pressed, the SB-412A operator's voice is sent to all four intercom channels simultaneously, whether or not any channel's Talk access is on. It also feeds the twelve switchboard lines, including those in the OFF position. All Page has no effect on any of the station's other functions.

Sidetone

Sidetone (the voice of the operator heard at his/her own station) must be carefully controlled to avoid acoustic feedback and/or system instability. The SB-412A has a front panel SIDETONE control (14) to add a set amount of sidetone to the unit's headset/speaker outputs, independent of any channel(s) that the operator is monitoring.

Each channel's SIDETONE NULL adjustment (this is located behind the unmarked hole, 15, beside each Talk toggle switch) is set at the factory for best (full) null with less than 500 feet of connected cable. Because of the controlled amount of added sidetone, the number of channels being monitored doesn't have much effect on the overall sidetone level.

When you are using a gooseneck mic with an external speaker, it's usually necessary to turn the sidetone control all the way down (counter-clockwise) to prevent acoustic feedback. Depending upon the relative positions of the mic and speaker, it may also be helpful to enable the dipper circuit, which helps prevent feedback. This automatically attentuates the station's speaker output when any of the Talk toggle switches are in the momentary ON position.

Termination

The termination switches (16) are set only during installation, and must NOT be changed unless a change in system wiring requires it.

Program Input

The SB-412A has Clear-Com's new switchable mic-level or line-level Program (auxiliary) preamp. A switch located on the rear panel (17) sets the circuit's input sensitivity so that either a mic (-50dBv) or line (-0dBv) level signal will produce full station output. The input, accessed from a rear panel 3-pin XLR connector (22), is balanced, but may be used single-ended if you tie one of the inputs to circuit common. Program audio from the preamp feeds to the Program buss for sending onto the intercom lines, and to the station's headset and speaker amplifiers. Program feed to each intercom line is controlled by individual trimpots (18) behind the access plate. The trimpots are set fully OFF at the factory. The program level heard in the station's headset/speaker is set by the front panel PROGRAM VOLUME control (19).

Call Signalling

Pressing the CALL button (20) causes the visual signalling voltage to be sent onto the intercom lines of only those channels whose Intercom Select buttons are engaged. This voltage is sensed by all stations on those channels (including the sending station), which cause the corresponding CALL LAMPS (21) to light brightly. A signal from another station is indicated in the same manner, whether or not the Intercom Select button is engaged. Individual LED's (7) above each of the switchboard assignment levers indicate an incoming call on any switchboard line(s), even those in the OFF position.

Power

The power switch (23) controls the AC power to the station; an integral neon bulb indicates when the unit is on. The circuit breaker (24) protects against DC power shorts. Any current load greater than two amperes will cause it to trip, causing the short indicator (25) to light. After removing the short, pressing the breaker button instantly restores normal operation.

The AC line voltage select switch (26) and external line fuse (27) permit instant change in the field between 115 and 230 VAC operation. Be certain to use the correct slow blow fuse (115VAC = 1A; 230V = 0.5A).

CHANNEL ASSIGNMENT NOTES:

Channel A--

Channel B--

Channel C--

Channel D--

MATRIX ASSIGNMENTS:

1.....

2.....

3.....

4.....

5.....

6.....

7.....

8.....

9.....

10.....

11.....

12.....

III-C. Special Features: ISO, IFB, and Split-Feed Headset Operation

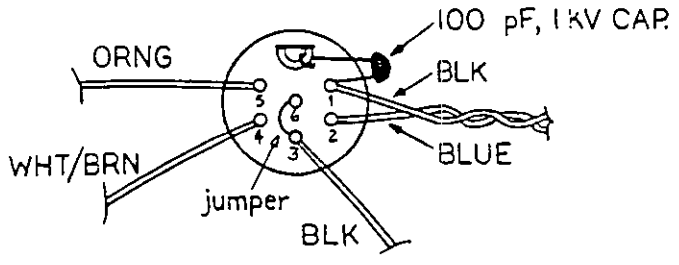
Refer to the printed circuit board diagram (page 30) for jumper locations.

The SB-412A (similar to the RM-400A and MS-400A) provides you with the capability to convert any one or more of its channels from regular two-way operation to either ISO or IFB operation, simply by adding one or two jumpers in the selected channel's circuitry.

The channel ISO function is engaged only while the channel's Talk toggle is in the momentary "(ON)" position. Channel ISO causes the SB-412A operator's voice feed to all other channels to be interrupted (except those also in the momentary (ON) position), so the operator may talk with the selected channel isolated from the rest of the system. **To set up an ISO channel**, add a diode (1N4148 type) to the pin sockets for D30, D32, D34, or D36 which correspond to the channels A, B, C, and D.

IFB operation, used extensively for cueing Talent, causes muting of program audio and simultaneously switches the cueing station's Talk feed for the intercom to the IFB channel(s). In addition to jumpers in the SB-412A, IFB operation requires a PIC-4 (which supports up to four separate IFB channels). Like ISO, the IFB circuitry is active only while the designated channel's Talk toggle is switched to the momentary (ON) position. The PIC-4 mutes the program audio in response to the signalling voltage that the IFB circuitry sends on the IFB channel. Converting a channel to IFB operation requires two jumpers: a 47k ohm resistor (1/4 or 1/8 watt) for the pin sockets of R136, R143, R150, or R157 (corresponding to channels A, B, C, and D) AND the diode listed above in the ISO conversion procedure.

The other special feature that involves an internal jumper is **"split feed"** for the headsets (program in one ear, intercom in the other). In most systems, the program and intercom audio are combined in both the headset and speaker outputs. By removing the 220k ohm resistor from the pin sockets for R9, you prevent program audio from being part of the intercom headset output. Next, connect the program headset output (the white/brown wire coiled up near the front panel) to Pin 4 of a 6-pin XLR insert, which you substitute for the standard 4-pin one. Connect the intercom headset output to Pin 5; Pins 3 and 6 are circuit common. The program will be in the left ear, the intercom will be in the right. See diagram below for the wiring detail of the connector.



HEADSET CONNECTOR
6-PIN INSERT:
WIRING SIDE

IV. TECHNICAL INFORMATION
IV-A. Circuit Description

There are two inputs to the main mic preamp, one for each headset connector. The input from the upper connector is switched, and is also used for the optional gooseneck mic. The two inputs are routed to the summing input of the mic preamp (IC2 pin 2) via J3 pins 5 & 6. A compressor circuit (Q1) reduces the gain (nominally +51 dB with a -55 dBv input) as necessary to maintain an output level near 0 dB. The talk signal branches to three sections: the talk buss, which feeds the station operator's voice to the intercom channels; the S/A (stage or set announce) circuit; and the side path, which bypasses the intercom channels to feed the operator's voice directly to the station's headset/speaker output (sidetone).

The feed from the talk buss to the intercom channels is controlled by a four-section analog switch (IC5). Each channel's talk access may be turned on by engaging that channel's Intercom Select button (if its talk pre-set is on) or by using the talk toggle associated with that channel. Following the signal path trough Channel A's line circuit, the station operator's voice is fed to the intercom line through the line driver (IC6a), while IC6b maintains a high impedance (to prevent line loading) and amplifies signals on the line to feed the listen buss. A portion of the talk signal is fed directly to the line buffer through P1 to allow the talk signal to be nulled out at the listen side. The output from the line buffer is switched to the listen buss directly by contacts on the Intercom Select switch (S2). Signals from the selected channels are combined in the summing amplifier (IC4a), which also mixes in sidetone via P6, feeding the combined output to the headset driver via P8 and the speaker amp via P7.

A signal on the program or auxiliary input is amplified by IC4b, configured as a differential or balanced-input amp. (For single-ended, unbalanced use, the signal is applied to one of the input terminals and the other one is grounded.) This output branches to the program buss for feeding to the intercom lines, as set by each channels' trimpot (P101-104) on the adjustment module, and directly to the headset and speaker amps via P5. An extra headset driver (IC1b) permits program and intercom in separate sides of a binaural headset, yet program and intercom are always combined in the speaker output.

The visual signalling circuits utilize a DC voltage (momentarily) impressed on the audio channel. The PNP darlington (Q9 in channel A's line circuit) is operated as a current source (to prevent line loading) when its base circuit is pulled low. The resulting voltage on the intercom line is sensed by the NPN darlington, Q5 (and its corresponding element in all other line circuits connected to this channel). Collector current through the forward-biased NPN transistor causes the lamp to light.

IV-B. Maintance & Warranty

Clear-Com's solid-state intercoms, power supplies, and interfaces are designed with a modular "building block" approach for easy system expansion and field servicing. Our chassis design incorporates highly efficient ventilation and conservatively engineered circuitry, assuring years of trouble-free service. Our packaging is the most rugged available, constructed from 16-gauge aluminum or stainless steel, glass epoxy, plug-in PC Boards. Clear-Com is heavily shielded against hum, RFI pick-up, and solid-state dimmer (SCR) noise. All Clear-Com stations are compatible.

Before shipping, we test each unit to make sure it meets or exceeds all specifications. All units are guaranteed by Clear-Com against defects in materials and workmanship for one year following date of purchase (90 days for headsets; see warranty enclosed with each unit).

Our Engineering and Serice Departments will gladly provide you with technical advice and assistance. If you have any questions regarding operation, modifications, or applications of your intercom system, call us during business hours at (415) 861-6666, Pacific Standard Time.

IV-C. Troubleshooting

Symptom	Cause	Remedy
System non-operable; power switch not lit	A. loss of AC power or B. internal fuse is blown; could be caused by power supply failure	A. plug unit into dependable AC source B. replace fuse; if it blows repeatedly, bridge rectifier or other component probably shorted inside power supply. Have power supply fixed.
Circuit breaker trips repeatedly; short circuit LED remains lit	A. shorted or mis-wired cabling B. defective remote station	A. remove cables, one at a time, from main station until faulty line is located; check for shorts between Pins 1 & 2 B. check remote units
Hum or buzz in system	A. inductive pick-up caused by close proximity of main or remote station to power lines or transformers. B. ground loop caused by improper ground-of system. C. 10 ohm chassis ground resistor (R14) in power supply is open* D. inductive pick-up by headset mic; check by switching mic on and off.	A. relocate offending unit B. reverse power cord, lift ground (see Section II). C. check resistance between chassis and Pin 1 of connector; it should be 10 ohms. If not, open power supply and replace resistor. D. move mic away from "hum field" or use carbon or electret headset.
Excessive background noise pick-up by mic	A. distance from mic to lips is too far B. volume too high C. too many mics on in system	A. move closer to mic B. turn down headset or speaker volume C. turn off all unused mics

CONTINUED

Symptom	Cause	Remedy
Feedback	acoutical	A. check sidetone levels B. check termination (should be only one per channel) C. volume too high at one station D. two or more speaker stations have mics on at once; speak one at a time (per channel) E. speaker volume up too high at station with gooseneck mic

*Power supply's 10-ohm resistor is opened when the system ground comes in contact wtih something "hot," with respect to the station's earth ground. Should this occur, we recommend you carefully check the system ground and AC distribution in the area. **NOTE: This is a potentially dangerous situation; if it occurs, SHOCK HAZARD may occur between the ground and the metal boom of the headset.**

IV-D. Specifications

AMPLIFIER DESIGN: IC amplifiers including solid-state switching and signalling circuits. Current-limited and short circuit protected.

MICROPHONE PRE-AMP:
Input: 200 ohms nominal, dynamic type
Input Level: -55dBv nominal*, -10dBv max.*
Frequency Response: 250 Hz-12 kHz, contoured for clarity
Limiter Range: 25dB
Gain Adjust: 5dB
Gain to Intercom Line: +37dB

HEADPHONE AMP:
Load Impedance: 50-2000 ohms
Output Level: at least +20dBv across 600 ohms
Distortion: <0.2% THD at 1kHz
Freq. Response: 150 Hz-18 kHz, +/-2dB
Gain from Intercom Line: +37dB

SPEAKER AMP:
Load Impedance: 8-50 ohms; 16Ω preferred
Output Level: 4 watts max. into 8 ohms
Distortion: <0.5% THD at 1kHz
Freq. Response: 200 Hz-15 kHz, +/-2dB
Gain from Intercom Line: +41dB

AUXILIARY (PROGRAM) AMP:
Gain to Intercom Line: switchable-- +45dB (mic); -5dB (line);
Input Impedance: 3.6k ohm (mic); 300k ohm (line), both balanced
Nominal Input Level: -65dBv (mic); -10dBv (line)
Frequency Response: 150 Hz-18 kHz, +/-2dB
Gain to Headset/Speaker: +78dB

POWER SUPPLY:
Output Voltage: 30 volts, regulated, with electronic overvoltage protection
Output Current: 2 amperes maximum, circuit-breaker protected, with electronic short circuit current limiting
Hum & Noise: <1mV
Capacity: 100 headset or 20 speaker stations

CONNECTORS:
Headset: two 4-pin male XLR
Intercom Lines: four 3-pin male XLR; **Switchboard:** twelve 3-pin male XLR
Program Input: 3-pin female XLR
S/A Output: 3-pin male XLR

SYSTEM OPERATING CONDITIONS:
Maximum Distance: 1000 feet (from terminating station to maintain all specifications, using Belden 8778 cable)
System Level: -15dBv nominal, 0dBv max.*

STATION OPERATION:
Channel Separation: ≥50dB
Signal to Noise: >60dB
Line Impedance: terminating (200 ohms) or bridging (≥15k ohms, 200-10k Hz), swit.
Visual Signal Send: call button sends signal only on lines with monitor switch engaged. Minimum output: 11VDC
Visual Signal Receive: independent of switch settings. Minimum sensitivity: 4VDC

AC POWER REQUIREMENTS
105-130VAC/210-260 VAC, 48-62 Hz, 80 watts maximum

DIMENSIONS
19"W x 3.5"H x 9"D (483mm x 89mm x 231mm)

***0dBv is referenced to 0.775 volts rms**

IV-E. Parts Lists

ASSEMBLY 720043 ASY SB-412A FRONT PANEL REV.A

P/N	DESCRIPTION	QTY
150048	CAP 100PF 1KV 20% RF CAP	1
210013	AAA SWC D4M CONNECTOR	2
240007	HAN PANEL HANDLE 2 INCH SMITH#1618	2
240015	AAA KNB ROGAN#RB-67-0-DC-ML.125 1/2 W/1/8 SHAFT	4
240020	KNB RED BUTTON FOR C&K SWITCH #8121	3
240024	KNB SB-412 SWITCH KNOB GREY WITH 510030	12
250249	MET SB-412A FRONT PANEL HORZ.	1
250252	MET MS-400A/RM-400A/SB-412A ACCESS PLATE	1
250261	MET BRACKET 4CH ADJ SUPPORT	1
280053	HDS GROMMET HARTWELL #HN3G-31-1	2
280054	HDS PLUNGER HARTWELL #HN3P-31-4-1	2
280067	HDS DRESS CONE NUT C&K #7025	3
280098	HDS 1X1/4 INCH NYLON SPACER SMITH #4062	3
280099	HDS .374X1/4 HEX NYLON STANDOFF SMITH#4378	4
280100	HDS .25X4-40 HEX MACHINE SCREW BLACK	4
280101	HDS 5/16X4-40 PAN HEAD NYLON SCREW	3
390010	LED PANEL MTG SQUARE RED LED GEN INST#CMP(4-8B)	1
390011	BEZ BEZEL SET FOR 390010 G.I#MP65(4-8B)	1
410012	RES CF 1/4W 5% 3.9K OHMS	1
410028	RES CF 1/4W 5% 220K OHMS	1
470020	AAA REV 100K LINEAR PC MTG CTS#FB6645	4
510002	SWT POWER ILLUM. ROCKER ARCOL.#1403ACBR2	1
510006	SWT MINI-TOG W/LONG LEADS NKK#M2012ESG13	2
510028	AAA SWT SNAP-ACTION C&K#8121W8025RED3	2
510041	SWT DPDT SNAP ACTION C&K #8221YAV2	1
520028	BKR 1.6 A CKT BKR HOSIDEN# TBC6051-11-0672	1
710095	ASY MATRIX SWITCH MODULE W/O ISO REV.B	1
710098	ASY MATRIX CIRCUIT MODULE REV. D	1

ASSEMBLY 720046 ASSY SB-412A REAR PANEL REV.A

P/N	DESCRIPTION	QTY
210002	AAA SWC D3F CONNECTOR	1
210003	AAA SWC D3M CONNECTOR	17
210055	SWC JACK FOR SPEAKER EXT.W/SWITCH #N112A	1
210067	TER WIRE NUT FOR #22 GUAGE WIRE HOL#NP5115	1
210082	TER CRIMP SLIP-ON .187 IN RED AMP#640946-1	3
210088	TER CRIMP SPADE LUG (#6) AMP#640811-1	1
210089	TER CRIMP SLIP-ON .25 IN RED AMP#640932-1	2
250256	MET SB-412A REAR PANEL	1
410021	RES CF 1/4W 5% 47K OHMS	2
410044	RES CF 1/4W 5% 680 OHMS	1
410046	RES CF 1/4W 5% 560 OHMS	2
510053	SWT DPDT SLIDE SWT SCRFT#46256LFR LINE VLT SELECT	1
510065	SWT SLIDE SW CHASSIS MTG DPDT SWCRFT#56206L1	1
520021	FUS 3AG 1 AMP SLOW BLOW #313001	1
520027	FUS SQ BEZEL FUSEHOLDER MOUSER#44FH113	1
560011	AAA TRN POWER XFORMER CARSON#6832	1
610000	CBL POWER CORD SET 3-COND BELDEN# 17237	1
640004	STR HEYCO #SR-SP-4	1

ASSEMBLY SB-412A FGI SB-412A SWITCHBOARD REV.A

P/N	DESCRIPTION	QTY
180000	TRN FILTER CHOKE 15MH CARSON# 6450	1
210046	AMP 7 PIN MTA HOUSING #640440-7	1
210048	AMP 12 PIN MTA HOUSING #1-640440-2	4
210062	AMP 4 PIN MTA HOUSING #640440-4	1
210066	AMP 5 PIN MTA HOUSING #640440-5	1
210082	TER CRIMP SLIP-ON .187 IN RED AMP#640946-1	8
210117	AMP 6 PIN MTA HOUSING AMP #640440-6	1
250264	MET 3 1/2 IN RACK CHASSIS REVISED	1
250265	MET 3 1/2 IN RACK COVER	1
280030	HDS INS STANDOFF 1/4 DIA 1/4IN LONG FOR #4 SCREW	1
280103	HDS PCB SUPPORT RICHCO#LCBSB-4-NA	2
280115	HDS CHASSIS WIRE TIE RICHCO#KL350A	3
710044	ASY 1/2 REG POWER SUPPLY MODULE REV.E	1
710159	ASY REVISED 4 CHAN MAIN MODULE ASSY REV.A	1
720043	ASY SB-412A FRONT PANEL REV.A	1
720046	ASSY SB-412A REAR PANEL REV.A	1
735006	ASY HARNESS REVISED 4CH J1/J3/J4	1
735008	ASY HARNESS REVISED 4CH SB-412A	1
735010	ASY HARNESS J2 SB-412A	1
810023	MAN SB-412A INSTRUCTION MANUAL	1

ASSEMBLY 710159 ASY REVISED 4 CHAN MAIN MODULE ASSY REV.A

P/N	DESCRIPTION	QTY	REF DESIG
150002	AAA CAE 1UF N.P. ELECTROLYTIC 50V R.L.	14	C74 C79 C69 C64 C32 C31 C54 C46 C40 C36 C57 C51 C49 C48
150005	CAP .047 POLY DNE 10% 50V 5MM	3	C1 C16 C15
150006	CAD 100PF DISC 10%	1	C21
150007	CAD 200PF DISC 10%	5	C82 C77 C72 C67 C22
150009	AAA CAT 1UF TANTALUM 35V A.L.	2	C97 C95
150010	CAE 22UF ELECTROLYTIC 16V R.L.	2	C20 C2
150011	CAE 100UF ELECTROLYTIC 35V R.L.	2	C99 C84
150013	CAD 15PF DISC 10%	5	C19 C61 C60 C63 C62
150014	CAD 470PF CERAMIC DISC 10% 50V	3	C9 C25 C10
150016	CAD .005UF DISC 10%	6	C6 C41 C37 C5 C55 C47
150021	CAE 220UF ELECTROLYTIC 35V R.L.	1	C23
150026	CAD 39PF DISC 5%	3	C26 C33 C28
150032	CAT 22UF 16VDC TANTALUM R.L.	1	C102
150034	CAN .22UF MONOLYTHIC 50V	1	C24
150035	AAA CAN .1 MONOLYTHIC 104ZU 50V	6	C65 C34 C100 C80 C75 C70
150043	CAN .47UF MONOLYTHIC 50V	1	C14
150044	CAT 4.7 UF TANTALUM 35V R.L.	1	C8
150061	CAD 680PF DISC 10% 50V	4	C83 C78 C73 C68
150065	CAE 2.2UF N.P. ELECTROLYTIC 50V	2	C29 C4
150067	CAM .01UF MYLAR 50V 10%	1	C96
150068	CAM .0047UF MYLAR 50V 10%	1	C27
150078	CAM .047 MONOLYTHIC 10% 50V	14	C58 C53 C52 C45 C44 C39 C38 C59 C101 C12 C81 C76 C71 C66
150080	CAM .22UF MONOLYTHIC 104ZU 100V	2	C17 C18
150082	CAM .022 UF MONO CK05 10% 50V	5	C42 C13 C56 C50 C43
150091	CAT 47UF 6V TANTALUM R.L.	1	C35
150094	CAD 680PF 5% DISC OR MOND 50V .25LS	1	C11
150098	CAD 22PF 10% 50V .2 LS .15 THK	1	C3
170087	PCB REVISED 4 CHANNEL SERIES PCB	1	
210075	TER DIP 16 PIN DIP SOCKET	1	IC5
210101	SOC 8 PIN DIP SOCKET	7	IC8 IC9 IC7 IC6 IC4 IC2 IC1
210109	SOC SINGLE PIN SOCKET FOR DLC OPTION JUMPS	29	X R157 R150 R143 R136 X X X X X X X X X D36 D34 D32 D30 R9 JP1
210112	TER HEADER MULTI PIN HEADER(MIN 18 PIN)	39	J1(12) J2(12) J3(6) J4(5) J6(4) X X X X X X X X X

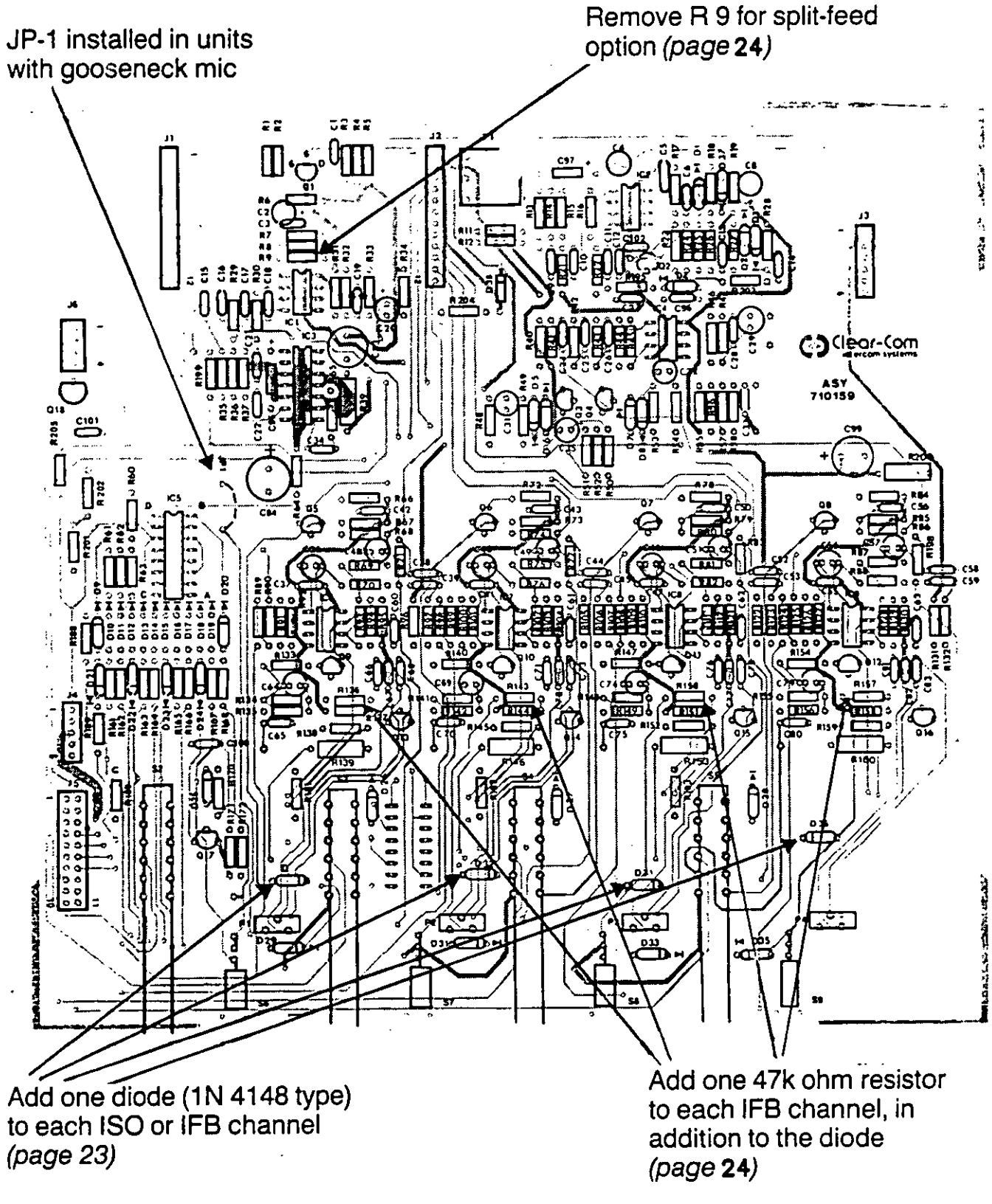
4-Channel Main Module Assy., cont'd.

410017	RES CF 1/4W 5% 15K OHMS	8	R171 R158 R151 R144 R137 R202 R3 R4
410018	RES CF 1/4W 5% 22K OHMS	12	R44 R32 R40 R35 R199 R126 R109 R100 R91. R57 R46 R31
410020	RES CF 1/4W 5% 33K OHMS	2	R36 R29
410021	RES CF 1/4W 5% 47K OHMS	18	R201 R198 R83 R77 R71 R159 R156 R152 R149 R145 R142 R138 R135 R157 R150 R143 R136 R172
410023	RES CF 1/4W 5% 56K OHMS	4	R103 R112 R94 R129
410024	RES CF 1/4W 5% 100K OHMS	17	R205 R203 R166 R164 R162 R168 R74 R68 R21 R189 R188 R167 R165 R163 R161 R86 R80
410025	RES CF 1/4W 5% 68K OHMS	4	R131 R122 R105 R96
410028	RES CF 1/4W 5% 220K OHMS	6	R18 R17 R7 R58 R9 R47
410030	RES CF 1/4W 5% 470K OHMS	6	R1 R85 R79 R73 R67 R25
410031	RES CF 1/4W 5% 12K OHMS	1	R22
410032	RES CF 1/4W 5% 18K OHMS	10	R204 R8 R155 R148 R141 R134 R125 R108 R99 R90
410033	RES CF 1/4W 5% 330K OHMS	1	R24
410035	RES CF 1/4W 5% 1.8K OHMS	2	R49 R53
410036	RES CF 1/4W 5% 6.8K OHMS	1	R195
410038	RES CF 1/4W 5% 82 OHMS	1	R23
410039	RES CF 1/4W 5% 47 OHMS	6	R84 R78 R72 R66 R54 R48
410040	RES CF 1/4W 5% 2.7K OHMS	1	R16
410041	RES CF 1/4W 5% 1.2K OHMS	4	R147 R140 R133 R154
410055	RES CF 1/4W 5% 1.5K OHMS	5	R14 R88 R82 R76 R70
410058	RES CF 1/4W 5% 1 MEGAOHM	5	R2 R63 R62 R61 R60
410059	RES CF 1/4W 5% 10 MEGAOHM	1	R28
410063	RES CF 1/8W 1% 6.81K OHMS	4	R130 R95 R121 R104
410065	RES CF 1/2W 5% 22 OHMS	1	R39
410066	RES CF 1/2W 5% 10 OHMS	1	R200
410067	RES CF 1/4W 5% 1.5 MEGAOHMS	1	R26
410071	RES CF 1/4W 5% 100 OHMS	2	R42 R51
410082	RES CF 1/2W 5% 470 OHMS	4	R146 R139 R160 R153
410084	RES CF 1/4W 5% 43K OHMS	5	R106 R97 R30 R132 R123
410085	RES CF 1/8W 1% 2.67K OHMS	4	R69 R87 R81 R75
410086	RES CF 1/8W 1% 20.0K OHMS	6	R111 R102 R93 R52 R50 R128
410089	RES MF 1/8W 1% 10K OHMS	2	R55 R56
410096	RES CF 5% 1/4 W 820 OHM	1	R37
410097	RES CF 1/4W 5% 240K OHMS	1	R33
410104	RES CF 1/4W 5% 3.0K OHMS	1	R15
470019	REV 50K TRIM POT V MTG. PIHER#PT-10H-50K	4	P1 P4 P3 P2
480000	DIO 1N4148 SIGNAL DIODE	32	D37 D36 D35 D34 D33 D32 D31 D30 D29 D28 D27 D26 D25 D24 D23 D22 D21 D20 D19 D18 D17 D16 D15 D14 D13 D12 D11 D10 D9 D8 D7 D6 D5 D4 D3 D2 D1
480001	DIO 1N4001 RECTIFIER DIODE	1	D38
480004	TRA MPS-A13 TRANSISTOR	4	Q8 Q7 Q6 Q5
480008	TRA MPS-A63 TRANSISTOR	4	Q12 Q11 Q10 Q9
480012	ICS LM384 IC POWER AMP 14-PIN DIP	1	IC3
480047	TRA 2N4401 NPN TRANSISTOR	8	Q18 Q17 Q16 Q15 Q14 Q13 Q4 Q3
480056	ICS RC4559NB DUAL OP AMP 8-PIN DIP	5	IC7 IC8 IC6 IC4 IC9
480061	TRA 2N5486 N CHANNEL JFET	1	Q1
480069	TRN 2N5639 N CHANNEL JFET	1	Q2
480070	AAA ICS NE5532 DUAL LO NOISE OP AMP	2	IC2 IC1
480073	ICS DG308A ANALOG SWITCH QUAD	1	IC5
510050	SWT SCH#F-N-00-4U-EE-N-21-01-16-01-B-AG-3-03	4	S2 S5 S4 S3
510057	SWT SPDT NKK#M2019EXG12/319 REV.THROW	4	S6 S7 S8 S9
560018	TRN 600CT/600CT PAN MAGNETICS #TTC108	1	T1
710160	ASY REVISED 4 CHAN ADJUST PC ASSY REV.A	1	

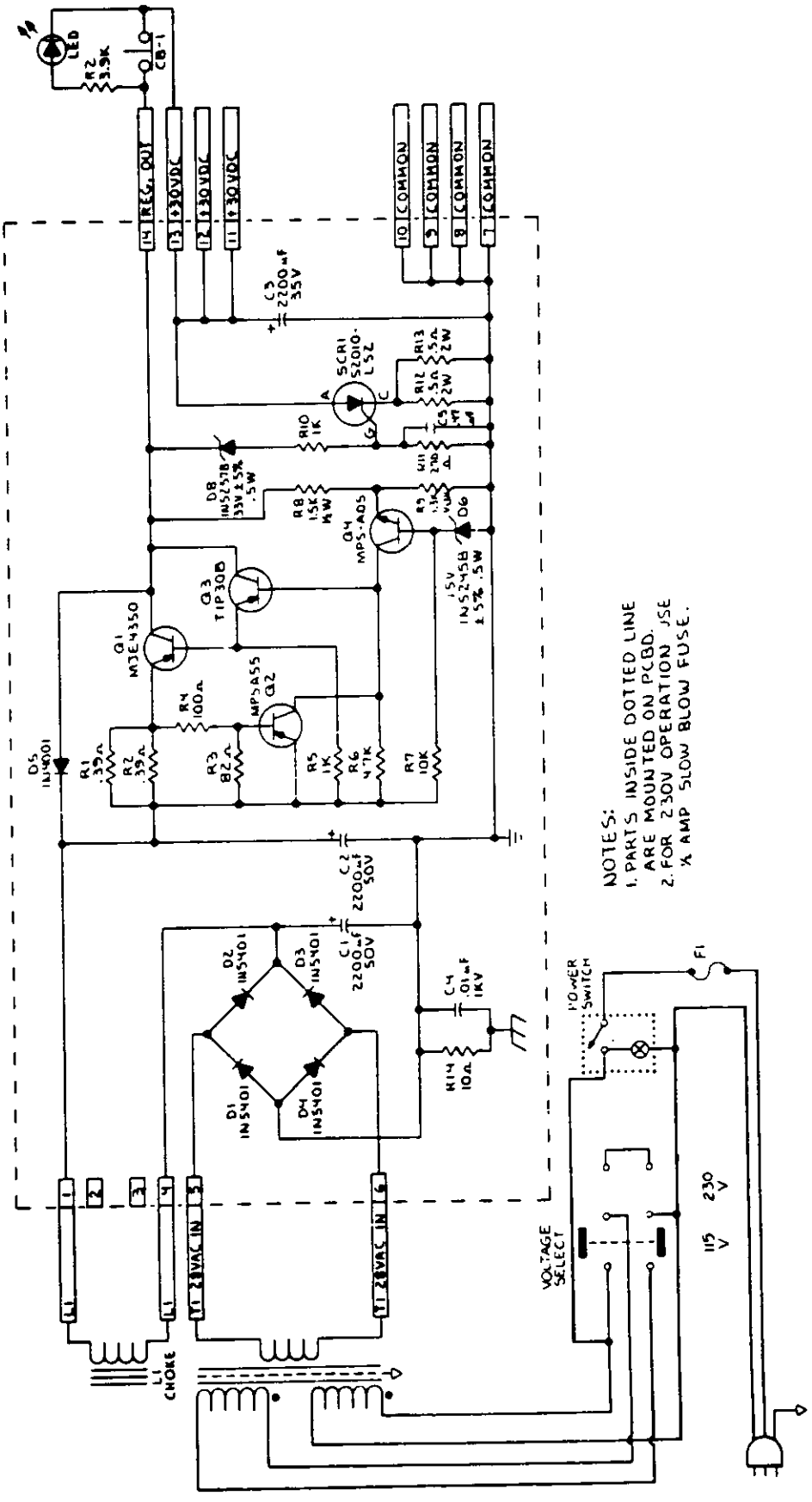
ASSEMBLY 710160 ASY REVISED 4 CHAN ADJUST PC ASSY REV.A

P/N	DESCRIPTION	QTY	REF DESIG
150027	CAE 10UF ELECTROLYTIC 16V R.L.	4	C103 C104 C102 C101
170088	PCB REVISED 4 CH SERIES ADJUSTMENT PCB	1	
210132	AMP 20 PIN R/A HEADER AMP#1-87563-0	1	J101
410007	RES CF 1/4W 5% 220 OHMS	4	R203 R201 R207 R205
410013	RES CF 1/4W 5% 4.7K OHMS	4	R204 R202 R208 R206
470019	REV 50K TRIM POT V MTG. PIHER#PT-10H-50K	4	P104 P103 P102 P101
510039	SWT MINI PIANO DIP SWITCH GRAYHILL #76PSB04	2	S102 S101

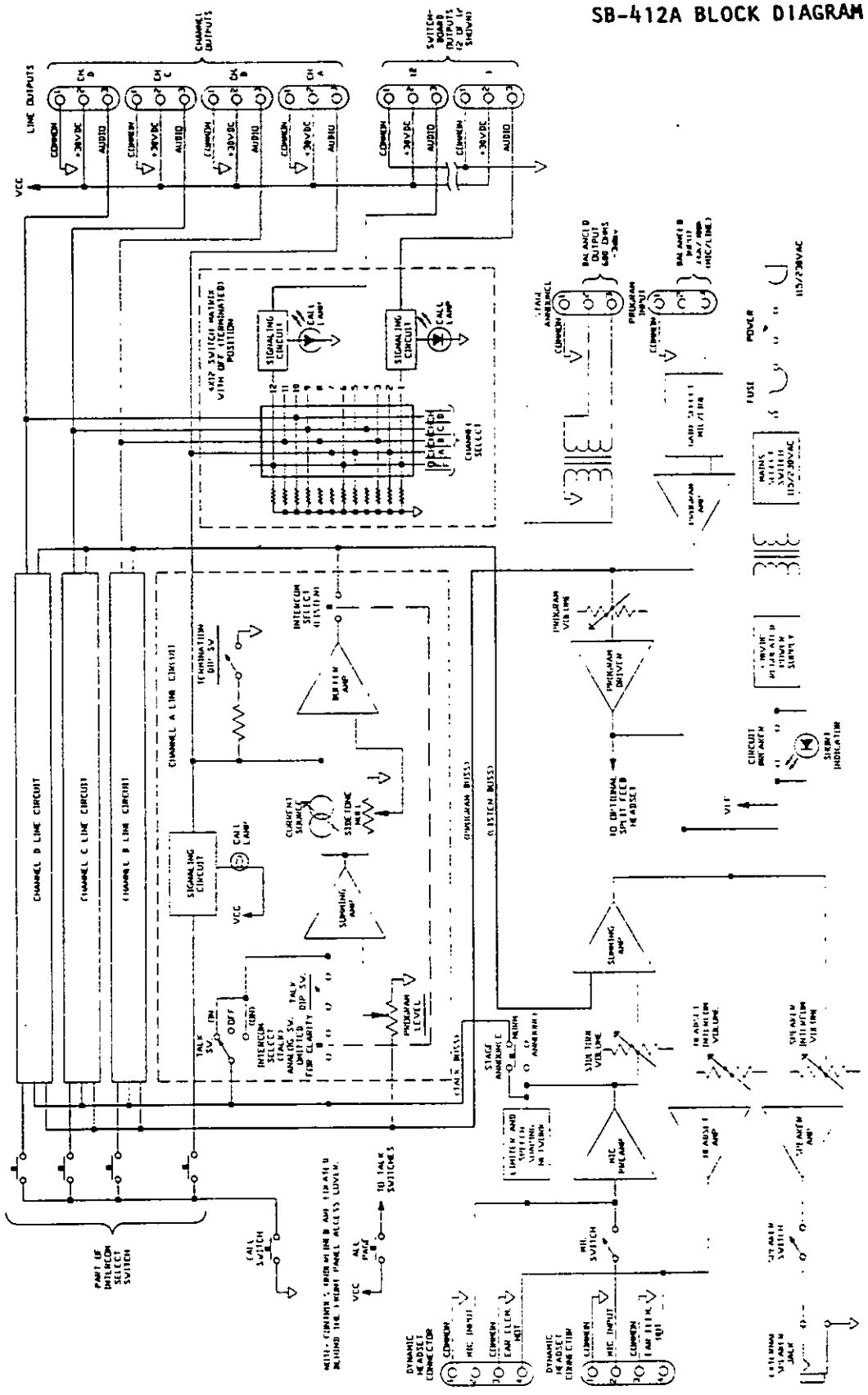
IV-G. Component Locations

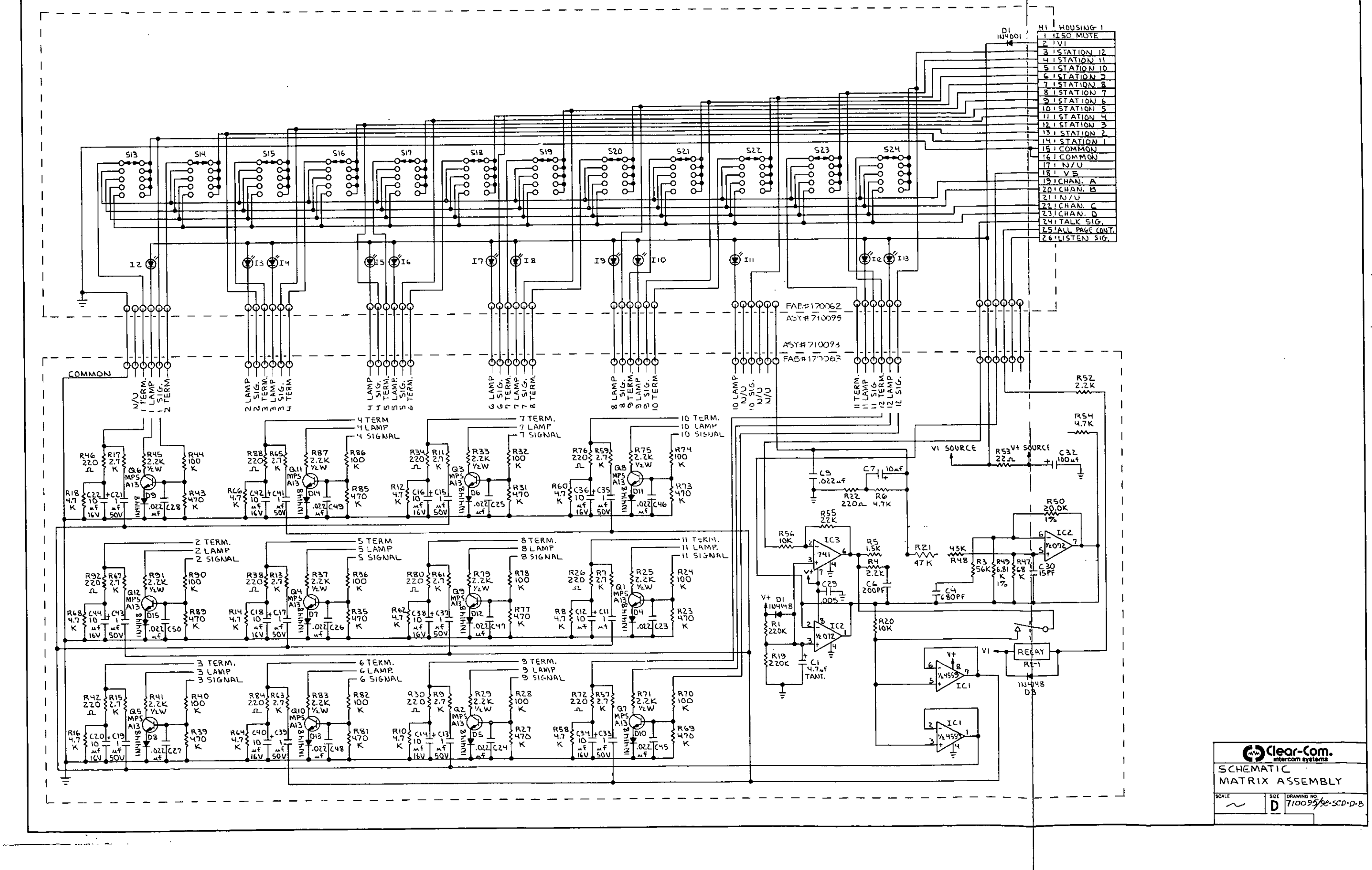

JP-1 installed in units with gooseneck mic
Remove R 9 for split-feed option *(page* **24***)*
Clear-Com
ASY 710159
Add one diode (1N 4148 type) to each ISO or IFB channel *(page 23)*
Add one 47k ohm resistor to each IFB channel, in addition to the diode *(page* **24***)*

POWER SUPPLY SCHEMATIC



SB-412A BLOCK DIAGRAM

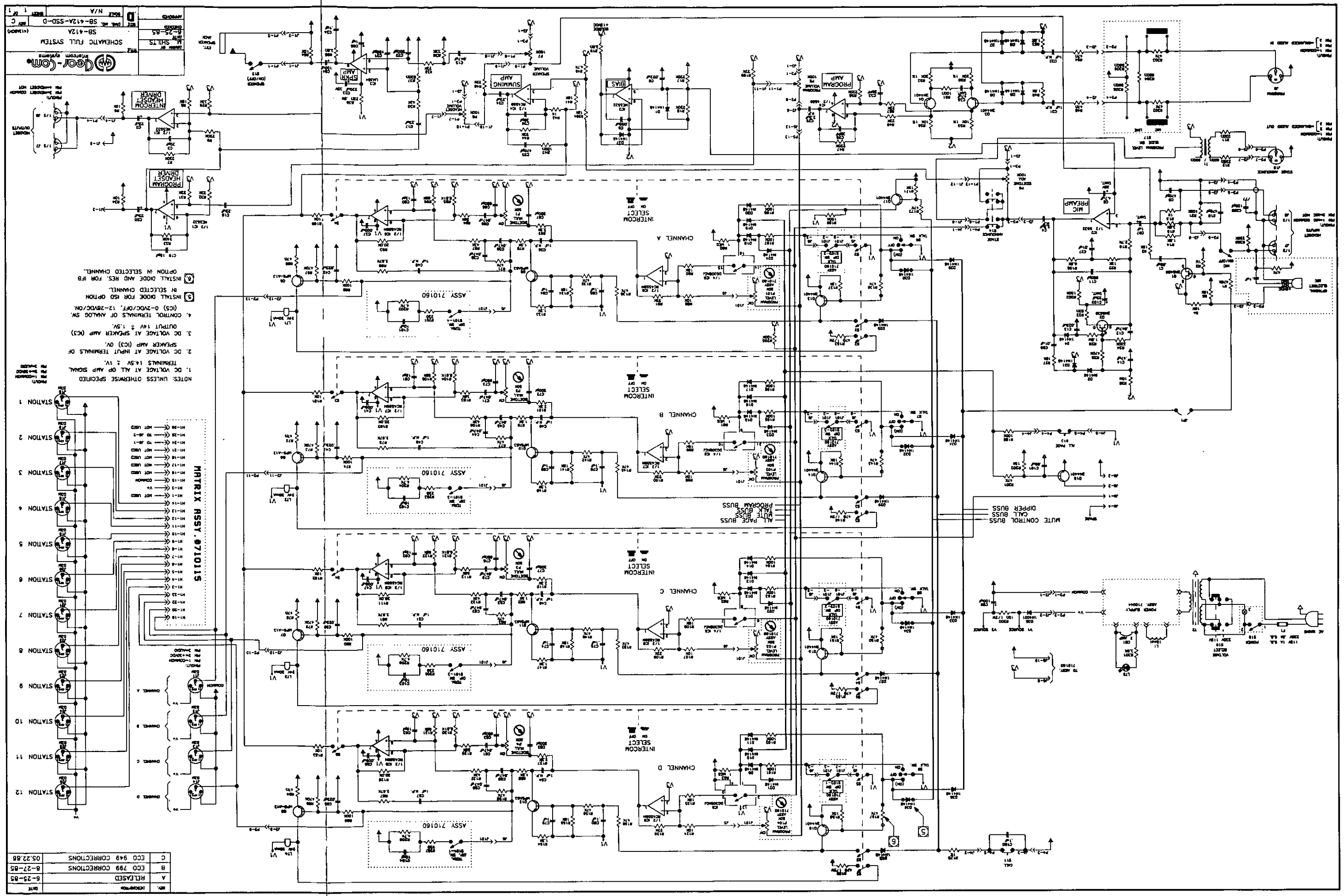



H1 HOUSING 1
1 ISO MUTE
2 VI
3 STATION 12
4 STATION 11
5 STATION 10
6 STATION 9
7 STATION 8
8 STATION 7
9 STATION 6
10 STATION 5
11 STATION 4
12 STATION 3
13 STATION 2
14 STATION 1
15 COMMON
16 COMMON
17 N/U
18 V5
19 CHAN. A
20 CHAN. B
21 N/U
22 CHAN. C
23 CHAN. D
24 TALK SIG.
25 ALL PAGE CONT.
26 LISTEN SIG.
D1 IN4001
S13 S14 S15 S16 S17 S18 S19 S20 S21 S22 S23 S24
I2 I3 I4 I5 I6 I7 I8 I9 I10 I11 I12 I13
FAB#170062
ASY#710095
ASY#710096
FAB#170063
COMMON
N/U 1 TERM. 1 LAMP 1 SIG. 2 TERM.
2 LAMP 2 SIG. 3 TERM. 3 LAMP 3 SIG. 4 TERM
4 LAMP 4 SIG. 5 TERM. 5 LAMP 5 SIG. 6 TERM.
6 LAMP 6 SIG. 7 TERM. 7 LAMP 7 SIG. 8 TERM.
8 LAMP 8 SIG. 9 TERM. 9 LAMP 9 SIG. 10 TERM
10 LAMP N/U 10 SIG. N/U N/U
11 TERM. 11 LAMP 11 SIG. 12 TERM. 12 LAMP 12 SIG.
4 TERM 4 LAMP 4 SIGNAL
7 TERM. 7 LAMP 7 SIGNAL
10 TERM. 10 LAMP 10 SISNAL
2 TERM. 2 LAMP 2 SIGNAL
5 TERM 5 LAMP 5 SIGNAL
8 TERM. 8 LAMP 8 SIGNAL
11 TERM. 11 LAMP. 11 SIGNAL
3 TERM. 3 LAMP 3 SIGNAL
6 TERM. 6 LAMP. 6 SIGNAL
9 TERM. 9 LAMP 9 SIGNAL
R46 220Ω R17 2.7K R45 2.2K ½W R44 100K R18 4.7K C22 10 mf 16V C21 1 mf 50V Q6 MPS A13 D9 IN4148 .022 mf C28 R43 470K
R88 220Ω R65 2.7K R87 2.2K ½W R86 100K R66 4.7K C42 10 mf 16V C41 1 mf 50V Q11 MPS A13 D14 IN4148 .022 mf C49 R85 470K
R34 220Ω R11 2.7K R33 2.2K ½W R32 100K R12 4.7K C16 10 mf 16V C15 1 mf 50V Q3 MPS A13 D6 IN4148 .022 mf C25 R31 470K
R76 220Ω R59 2.7K R75 2.2K ½W R74 100K R60 4.7K C36 10 mf 16V C35 1 mf 50V Q8 MPS A13 D11 IN4148 .022 mf C46 R73 470K
R92 220Ω R67 2.7K R91 2.2K ½W R90 100K R68 4.7K C44 10 mf 16V C43 1 mf 50V Q12 MPS A13 D15 IN4148 .022 mf C50 R89 470K
R38 220Ω R13 2.7K R37 2.2K ½W R36 100K R14 4.7K C18 10 mf 16V C17 1 mf 50V Q4 MPS A13 D7 IN4148 .022 mf C26 R35 470K
R80 220Ω R61 2.7K R79 2.2K ½W R78 100K R62 4.7K C38 10 mf 16V C37 1 mf 50V Q9 MPS A13 D12 IN4148 .022 mf C47 R77 470K
R26 220Ω R7 2.7K R25 2.2K ½W R24 100K R8 4.7K C12 10 mf C11 1 mf Q1 MPS A13 D4 IN4148 .022 mf C23 R23 470K
R42 220Ω R15 2.7K R41 2.2K ½W R40 100K R16 4.7K C20 10 mf 16V C19 1 mf 50V Q5 MPS A13 D8 IN4148 .022 mf C27 R39 470K
R84 220Ω R63 2.7K R83 2.2K ½W R82 100K R64 4.7K C40 10 mf 16V C39 1 mf 50V Q10 MPS A13 D13 IN4148 .022 mf C48 R81 470K
R30 220Ω R9 2.7K R29 2.2K ½W R28 100K R10 4.7K C14 10 mf 16V C13 1 mf 50V Q2 MPS A13 D5 IN4148 .022 mf C24 R27 470K
R72 220Ω R57 2.7K R71 2.2K ½W R70 100K R58 4.7K C34 10 mf 16V C33 1 mf 50V Q7 MPS A13 D10 IN4148 .022 mf C45 R69 470K
R52 2.2K
R54 4.7K
V1 SOURCE
R53 22Ω
V4 SOURCE
C32 100 mf
C9 .022 mf
C7 10 mf
R22 220Ω
R6 4.7K
R55 22K
R56 10K
IC3 741
R5 1.5K
R4 2.2K
C6 200PF
R21 47K
43K
R48
R50 20.0K 1%
IC2 ½ 072
R3 56K
R49 6.81K 1%
R47 68K
C30 15PF
C4 680PF
C29 .005
V+ D1 IN4148
R1 220K
R19 220K
IC2 ½ 072
C1 4.7 mf TANT.
R20 10K
RELAY
RE-1
V1
IN4148 D3
V+
IC1 ½ 4559
IC1 ½ 4559

Clear-Com. intercom systems

SCHEMATIC
MATRIX ASSEMBLY

SCALE	SIZE	DRAWING NO.
~	D	710095/96-SCD-D-B


SCHEMATIC FULL SYSTEM
SB-412A
SB-412A-SSD-D
D-25-85
N/A
SHEET 1 OF 1
NOTES: UNLESS OTHERWISE SPECIFIED
1. DC VOLTAGE AT ALL OP AMP SIGNAL TERMINALS 14.5V ± 1V.
2. DC VOLTAGE AT INPUT TERMINALS OF SPEAKER AMP (IC3) 0V.
3. DC VOLTAGE AT SPEAKER AMP (IC3) OUTPUT 14V ± 1.5V.
4. CONTROL TERMINALS OF ANALOG SW. (IC5) 0-2VDC/OFF, 12-28VDC/ON.
5 INSTALL DIODE FOR ISO OPTION IN SELECTED CHANNEL.
6 INSTALL DIODE AND RES. FOR IFB OPTION IN SELECTED CHANNEL.
MATRIX ASSY. #7101115
STATION 1
STATION 2
STATION 3
STATION 4
STATION 5
STATION 6
STATION 7
STATION 8
STATION 9
STATION 10
STATION 11
STATION 12
CHANNEL A
CHANNEL B
CHANNEL C
CHANNEL D
COMMON
ASSY 710160
INTERCOM SELECT
PROGRAM HEADSET DRIVER
INTERCOM HEADSET DRIVER
SPKR AMP
SUMMING AMP
BIAS
PROGRAM AMP
MIC PREAMP
ALL PAGE BUSS
MUTE BUSS
CALL BUSS
PROGRAM BUSS
MUTE CONTROL BUSS
CALL BUSS
DIMMER BUSS
REV. DESCRIPTION DATE
A RELEASED 6-25-85
B ECO 799 CORRECTIONS 8-27-85
C ECO 949 CORRECTIONS 05.22.86